Part 1: Executive Summary

2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care

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Introduction

Publication of the *2015 American Heart Association* (AHA) *Guidelines Update for Cardiopulmonary Resuscitation* (CPR) *and Emergency Cardiovascular Care* (ECC) marks 49 years since the first CPR guidelines were published in 1966 by an Ad Hoc Committee on Cardiopulmonary Resuscitation established by the National Academy of Sciences of the National Research Council.[1] Since that time, periodic revisions to the Guidelines have been published by the AHA in 1974,[2] 1980,[3] 1986,[4] 1992,[5] 2000,[6] 2005,[7] 2010,[8] and now 2015. The *2010 AHA Guidelines for CPR and ECC* provided a comprehensive review of evidence-based recommendations for resuscitation, ECC, and first aid. The *2015 AHA Guidelines Update for CPR and ECC* focuses on topics with significant new science or ongoing controversy, and so serves as an update to the *2010 AHA Guidelines for CPR and ECC* rather than a complete revision of the Guidelines.

The purpose of this Executive Summary is to provide an overview of the new or revised recommendations contained in the 2015 Guidelines Update. This document does not contain extensive reference citations; the reader is referred to Parts 3 through 9 for more detailed review of the scientific evidence and the recommendations on which they are based.

There have been several changes to the organization of the 2015 Guidelines Update compared with 2010. "Part 4: Systems of Care and Continuous Quality Improvement" is an important new Part that focuses on the integrated structures and processes that are necessary to create systems of care for both in-hospital and out-of-hospital resuscitation capable of measuring and improving quality and patient outcomes. This Part replaces the "CPR Overview" Part of the 2010 Guidelines.

Another new Part of the 2015 Guidelines Update is "Part 14: Education," which focuses on evidence-based recommendations to facilitate widespread, consistent, efficient and effective implementation of the AHA Guidelines for CPR and ECC into practice. These recommendations will target resuscitation education of both lay rescuers and healthcare providers. This Part replaces the 2010 Part titled "Education, Implementation, and Teams." The 2015 Guidelines Update does not include a separate Part on adult stroke because the content would replicate that already offered in the most recent AHA/American Stroke Association guidelines for the management of acute stroke.[9,10]

Finally, the 2015 Guidelines Update marks the beginning of a new era for the AHA Guidelines for CPR and ECC, because the Guidelines will transition from a 5-year cycle of periodic revisions and updates to a Web-based format that is continuously updated. The first release of the Web-based integrated Guidelines, now available online at ECCguidelines.heart.org is based on the comprehensive 2010 Guidelines plus the 2015 Guidelines Update. Moving forward, these Guidelines will be updated by using a continuous evidence evaluation process to facilitate more rapid translation of new scientific discoveries into daily patient care.

Creation of practice guidelines is only 1 link in the chain of knowledge translation that starts with laboratory and clinical science and culminates in improved patient outcomes. The AHA ECC Committee has set an impact goal of doubling bystander CPR rates and doubling cardiac arrest survival by 2020. Much work will be needed across the entire spectrum of knowledge translation to reach this important goal.

Evidence Review and Guidelines Development Process

The process used to generate the *2015 AHA Guidelines Update for CPR and ECC* was significantly different from the process used in prior releases of the Guidelines, and marks the planned transition from a 5-year cycle of evidence review to a continuous evidence evaluation process. The AHA continues to partner with the International Liaison Committee on Resuscitation (ILCOR) in the evidence review process. However, for 2015, ILCOR prioritized topics for systematic review based on clinical significance and availability of new

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evidence. Each priority topic was defined as a question in PICO (population, intervention, comparator, outcome) format. Many of the topics reviewed in 2010 did not have new published evidence or controversial aspects, so they were not rereviewed in 2015. In 2015, 165 PICO questions were addressed by systematic reviews, whereas in 2010, 274 PICO questions were addressed by evidence evaluation. In addition, ILCOR adopted the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) process for evidence evaluation and expanded the opportunity for public comment. The output of the GRADE process was used to generate the *2015 International Consensus on CPR and ECC Science With Treatment Recommendations* (CoSTR).[11,12]

The recommendations of the ILCOR 2015 CoSTR were used to inform the recommendations in the *2015 AHA Guidelines Update for CPR and ECC*. The wording of these recommendations is based on the AHA classification system for evidentiary review (see "Part 2: Evidence Evaluation and Management of Conflicts of Interest").

The *2015 AHA Guidelines Update for CPR and ECC* contains 315 classified recommendations. There are 78 Class I recommendations (25%), 217 Class II recommendations (68%), and 20 Class III recommendations (7%). Overall, 3 (1%) are based on Level of Evidence (LOE) A, 50 (15%) are based on LOE B-R (randomized studies), 46 (15%) are based on LOE B-NR (nonrandomized studies), 145 (46%) are based on LOE C-LD (limited data), and 73 (23%) are based on LOE C-EO (consensus of expert opinion). These results highlight the persistent knowledge gap in resuscitation science that needs to be addressed through expanded research initiatives and funding opportunities.

As noted above, the transition from a 5-year cycle to a continuous evidence evaluation and Guidelines update process will be initiated by the 2015 online publication of the AHA Integrated Guidelines for CPR and ECC at ECCguidelines.heart.org. The initial content will be a compilation of the 2010 Guidelines and the 2015 Guidelines Update. In the future, the Scientific Evidence Evaluation and Review System (SEERS) Web-based resource will also be periodically updated with results of the ILCOR continuous evidence evaluation process at www.ilcor.org/seers.

Part 3: Ethical Issues

As resuscitation practice evolves, ethical considerations must also evolve. Managing the multiple decisions associated with resuscitation is challenging from many perspectives, especially when healthcare providers are dealing with the ethics surrounding decisions to provide or withhold emergency cardiovascular interventions.

Ethical issues surrounding resuscitation are complex and vary across settings (in or out of hospital), providers (basic or advanced), patient population (neonatal, pediatric, or adult), and whether to start or when to terminate CPR. Although the ethical principles involved have not changed dramatically since the 2010 Guidelines were published, the data that inform many ethical discussions have been updated through the evidence review process. The 2015 ILCOR evidence review process and resultant 2015 Guidelines Update include several recommendations that have implications for ethical decision making in these challenging areas.

Significant New and Updated Recommendations That May Inform Ethical Decisions

- The use of extracorporeal CPR (ECPR) for cardiac arrest
- Intra-arrest prognostic factors for infants, children, and adults
- Prognostication for newborns, infants, children, and adults after cardiac arrest
- Function of transplanted organs recovered after cardiac arrest

New resuscitation strategies, such as ECPR, have made the decision to discontinue cardiac arrest measures more complicated (see "Part 6: Alternative Techniques and Ancillary Devices for Cardiopulmonary Resuscitation" and "Part 7: Adult Advanced Cardiovascular Life Support"). Understanding the appropriate use, implications, and likely benefits related to such new treatments will have an impact on decision making. There is new information regarding prognostication for newborns, infants, children, and adults with cardiac arrest and/or after cardiac arrest (see "Part 13: Neonatal Resuscitation," "Part 12: Pediatric Advanced Life Support," and "Part 8: Post–Cardiac Arrest Care"). The increased use of targeted temperature management has led to new challenges for predicting neurologic outcomes in comatose post–cardiac arrest patients, and the latest data about the accuracy of particular tests and studies should be used to guide decisions about goals of care and limiting interventions.

With new information about the success rate for transplanted organs obtained from victims of cardiac arrest, there is ongoing discussion about the ethical implications around organ donation in an emergency setting. Some of the different viewpoints on important ethical concerns are summarized in "Part 3: Ethical Issues." There is also an enhanced awareness that although children and adolescents cannot make legally binding decisions, information should be shared with them to the extent possible, using appropriate language and information for their level of development. Finally, the phrase "limitations of care" has been changed to "limitations of interventions," and there is increasing availability of the Physician Orders for Life-Sustaining Treatment (POLST) form, a new method of legally identifying people who wish to have specific limits on interventions at the end of life, both in and out of healthcare facilities.

Part 4: Systems of Care and Continuous Quality Improvement

Almost all aspects of resuscitation, from recognition of cardiopulmonary compromise, through cardiac arrest and resuscitation and post–cardiac arrest care, to the return to productive life, can be discussed in terms of a system or systems of care. Systems of care consist of multiple working parts that are interdependent, each having an effect on every other aspect of the care within that system. To bring about any improvement, providers must recognize the interdependency of the various parts of the system. There is also increasing recognition that out-of-hospital cardiac arrest (OHCA) and in-hospital cardiac arrest (IHCA) systems of care must function differently. "Part 4: Systems of Care and Continuous Quality Improvement" in this 2015 Guidelines Update makes a clear distinction between the two systems, noting that OHCA frequently is the result of an unexpected event with a reactive element, whereas the focus on IHCA is shifting from reactive resuscitation to prevention. New Chains of Survival are suggested for in-hospital and out-of-hospital systems of care, with relatively recent in-hospital focus on prevention of arrests. Additional emphasis should be on continuous quality improvement by identifying the problem that is limiting survival, and then by setting goals, measuring progress toward those goals, creating accountability, and having a method to effect change in order to improve outcomes.

This new Part of the AHA Guidelines for CPR and ECC summarizes the evidence reviewed in 2015 with a focus on the systems of care for both IHCA and OHCA, and it lays the framework for future efforts to improve these systems of care. A universal taxonomy of systems of care is proposed for stakeholders. There are evidence-based recommendations on how to improve these systems.

Significant New and Updated Recommendations

In a randomized trial, social media was used by dispatchers to notify nearby potential rescuers of a possible cardiac arrest. Although few patients ultimately received CPR from volunteers dispatched by the notification system, there was a higher rate of bystander-initiated CPR (62% versus 48% in the control group).[13] Given the low risk of harm and the potential benefit of such notifications, municipalities could consider incorporating these technologies into their OHCA system of care. It may be reasonable for communities to incorporate, where available, social media technologies that summon rescuers who are willing and able to perform CPR and are in close proximity to a suspected victim of OHCA (Class IIb, LOE B-R).

Specialized cardiac arrest centers can provide comprehensive care to patients after resuscitation from cardiac arrest. These specialized centers have been proposed, and new evidence suggests that a regionalized approach to OHCA resuscitation may be considered that includes the use of cardiac resuscitation centers.

A variety of early warning scores are available to help identify adult and pediatric patients at risk for deterioration. Medical emergency teams or rapid response teams have been developed to help respond to patients who are deteriorating. Use of scoring systems to identify these patients and creation of teams to respond to those scores or other indicators of deterioration may be considered, particularly on general care wards for adults and for children with high-risk illnesses, and may help reduce the incidence of cardiac arrest.

Evidence regarding the use of public access defibrillation was reviewed, and the use of automated external defibrillators (AEDs) by laypersons continues to improve survival from OHCA. We continue to recommend implementation of public access defibrillation programs for treatment of patients with OHCA in communities who have persons at risk for cardiac arrest.

Knowledge Gaps

- What is the optimal model for rapid response teams in the prevention of IHCA, and is there evidence that rapid response teams improve outcomes?
- What are the most effective methods for increasing bystander CPR for OHCA?
- What is the best composition for a team that responds to IHCA, and what is the most appropriate training for that team?

Part 5: Adult Basic Life Support and Cardiopulmonary Resuscitation Quality

New Developments in Basic Life Support Science Since 2010

The 2010 Guidelines were most notable for the reorientation of the universal sequence from A-B-C (Airway, Breathing, Compressions) to C-A-B (Compressions, Airway, Breathing) to minimize time to initiation of chest compressions. Since 2010, the importance of high-quality chest compressions has been reemphasized, and targets for compression rate and depth have been further refined by relevant evidence. For the untrained lay rescuer, dispatchers play a key role in the recognition of abnormal breathing or agonal gasps as signs of cardiac arrest, with recommendations for chest compression–only CPR.

This section presents the updated recommendations for the 2015 adult basic life support (BLS) guidelines for lay rescuers and healthcare providers. Key changes and continued points of emphasis in this 2015 Guidelines Update include the following: The crucial links in the adult Chain of Survival for OHCA are unchanged from 2010; however, there is increased emphasis on the rapid identification of potential cardiac arrest by dispatchers, with immediate provision of CPR instructions to the caller. These Guidelines take into consideration the ubiquitous presence of mobile phones that can allow the rescuer to activate the emergency response system without leaving the victim's side. For healthcare providers, these recommendations allow flexibility for activation of the emergency response to better match the provider's clinical setting. More data are available indicating that high-quality CPR improves survival from cardiac arrest. Components of high-quality CPR include

- Ensuring chest compressions of adequate rate
- Ensuring chest compressions of adequate depth
- Allowing full chest recoil between compressions
- Minimizing interruptions in chest compressions
- Avoiding excessive ventilation

Recommendations are made for a simultaneous, choreographed approach to performance of chest compressions, airway management, rescue breathing, rhythm detection, and shock delivery (if indicated) by an integrated team of highly trained rescuers in applicable settings.

Significant New and Updated Recommendations

Many studies have documented that the most common errors of resuscitation are inadequate compression rate and depth; both errors may reduce survival. New to this 2015 Guidelines Update are upper limits of recommended compression rate based on preliminary data suggesting that excessive rate may be associated with lower rate of return of spontaneous circulation (ROSC). In addition, an upper limit of compression depth is introduced based on a report associating increased non–life-threatening injuries with excessive compression depth.

- In adult victims of cardiac arrest, it is reasonable for rescuers to perform chest compressions at a rate of 100 to 120/min (Class IIa, LOE C-LD). The addition of an upper limit of compression rate is the result of 1 large registry study associating extremely rapid compression rates with inadequate compression depth.
- During manual CPR, rescuers should perform chest compressions at a depth of at least 2 inches or 5 cm for an average adult, while avoiding excessive chest compression depths (greater than 2.4 inches [6 cm]) (Class I, LOE C-LD). The addition of an upper limit of compression depth followed review of 1 publication suggesting potential harm from excessive chest compression depth (greater than 6 cm, or 2.4 inches). Compression depth may be difficult to judge without use of feedback devices, and identification of upper limits of compression depth may be challenging.
- In adult cardiac arrest, total preshock and postshock pauses in chest compressions should be as short as possible (Class I, LOE C-LD) because shorter pauses can be associated with greater shock success, ROSC, and, in some studies, higher survival to hospital discharge. The need to reduce such pauses has received greater emphasis in this 2015 Guidelines Update.
- In adult cardiac arrest with an unprotected airway, it may be reasonable to perform CPR with the goal of a chest compression fraction as high as possible, with a target of at least 60% (Class IIb, LOE C-LD). The addition of this target compression fraction to the 2015 Guidelines Update is intended to limit interruptions in compressions and to maximize coronary perfusion and blood flow during CPR.
- For patients with known or suspected opioid addiction who have a definite pulse but no normal breathing or only gasping (ie, a respiratory arrest), in addition to providing standard BLS care, it is reasonable for appropriately trained BLS providers to administer intramuscular or intranasal naloxone (Class IIa, LOE C-LD). It is reasonable to provide opioid overdose response education with or without naloxone distribution to persons at risk for opioid overdose in any setting (Class IIa, LOE C-LD). For more information, see "Part 10: Special Circumstances of Resuscitation."
- For witnessed OHCA with a shockable rhythm, it may be reasonable for emergency medical service (EMS) systems with priority-based, multi-tiered response to delay positive-pressure ventilation by using a strategy of up to 3 cycles of 200 continuous compressions with passive oxygen insufflation and airway adjuncts (Class IIb, LOE C-LD).
- We do not recommend the routine use of passive ventilation techniques during conventional CPR for adults, because the usefulness/effectiveness of these techniques is unknown (Class IIb, LOE C-EO). However, in EMS systems that use bundles of care involving continuous chest compressions, the use of passive ventilation techniques may be considered as part of that bundle (Class IIb, LOE C-LD).
- It is recommended that emergency dispatchers determine if a patient is unconscious with abnormal breathing after acquiring the requisite information to determine the location of the event (Class I, LOE C-LD).
- If the patient is unconscious with abnormal or absent breathing, it is reasonable for the emergency dispatcher to assume that the patient is in cardiac arrest (Class IIa, LOE C-LD).
- Dispatchers should be educated to identify unconsciousness with abnormal and agonal gasps across a range of clinical presentations and descriptions (Class I, LOE C-LD).
- We recommend that dispatchers should provide chest compression–only CPR instructions to callers for adults with suspected OHCA (Class I, LOE C-LD).
- It is reasonable for healthcare providers to provide chest compressions and ventilation for all adult patients in cardiac arrest, from either a cardiac or a noncardiac cause (Class IIb, LOE C-LD). When the victim has an advanced airway in place during CPR, rescuers no longer deliver cycles of 30 compressions and 2 breaths (ie, they no longer interrupt compressions to deliver 2 breaths). Instead, it may be reasonable for the provider to deliver 1 breath every 6 seconds (10 breaths per minute) while continuous chest compressions are being performed (Class IIb, LOE C-LD). When the victim has an advanced airway in place during CPR, it may be reasonable for the provider to deliver 1 breath every 6 seconds (10 breaths per minute) while continuous chest compressions are being performed (Class IIb, LOE C-LD). This simple rate, rather than a range of breaths per minute, should be easier to learn, remember, and perform.
- There is insufficient evidence to recommend the use of artifact-filtering algorithms for analysis of electrocardiographic (ECG) rhythm during CPR. Their use may be considered as part of a research program or if an EMS system has already incorporated ECG artifact-filtering algorithms in its resuscitation protocols (Class IIb, LOE C-EO).
- It may be reasonable to use audiovisual feedback devices during CPR for real-time optimization of CPR performance (Class IIb, LOE B-R).
- For victims with suspected spinal injury, rescuers should initially use manual spinal motion restriction (eg, placing 1 hand on either side of the patient's head to hold it still) rather than immobilization devices, because use of immobilization devices by lay rescuers may be harmful (Class III: Harm, LOE C-LD).

Knowledge Gaps

- The optimal method for ensuring adequate depth of chest compressions during manual CPR
- The duration of chest compressions after which ventilation should be incorporated when using Hands-Only CPR
- The optimal chest compression fraction
- Optimal use of CPR feedback devices to increase patient survival

Part 6: Alternative Techniques and Ancillary Devices for Cardiopulmonary Resuscitation

High-quality conventional CPR (manual chest compressions with rescue breaths) generates about 25% to 33% of normal cardiac output and oxygen delivery. A variety of alternatives and adjuncts to conventional CPR have been developed with the aim of enhancing coronary and cerebral perfusion during resuscitation from cardiac arrest. Since the 2010 Guidelines were published, a number of clinical trials have provided new data regarding the effectiveness of these alternatives. Compared with conventional CPR, many of these techniques and devices require specialized equipment and training. Some have been tested in only highly selected subgroups of cardiac arrest patients; this selection must be noted when rescuers or healthcare systems consider implementation of the devices.

Significant New and Updated Recommendations

- The Resuscitation Outcomes Consortium (ROC) Prehospital Resuscitation Impedance Valve and Early Versus Delayed Analysis (PRIMED) study (n=8718)[14] failed to demonstrate improved outcomes with the use of an impedance threshold device (ITD) as an adjunct to conventional CPR when compared with use of a sham device. This negative high-quality study prompted a Class III: No Benefit recommendation regarding routine use of the ITD.
- One large randomized controlled trial evaluated the use of active compression-decompression CPR plus an ITD.[15] The writing group found interpretation of the true clinical effect of active compression-decompression CPR plus an ITD challenging because of wide confidence intervals around the effect estimate and also because of methodological concerns. The finding of improved neurologically intact survival in the study, however, supported a recommendation that this combination may be a reasonable alternative with available equipment and properly trained providers.
- Three randomized clinical trials comparing the use of mechanical chest compression devices with conventional CPR have been published since the 2010 Guidelines. None of these studies demonstrated superiority of mechanical chest compressions over conventional CPR. Manual chest compressions remain the standard of care for the treatment of cardiac arrest, but mechanical chest compression devices may be a reasonable alternative for use by properly trained personnel. The use of the mechanical chest compression devices may be considered in specific settings where the delivery of high-quality manual compressions may be challenging or dangerous for the provider (eg, prolonged CPR during hypothermic cardiac arrest, CPR in a moving ambulance, CPR in the angiography suite, CPR during preparation for ECPR), provided that rescuers strictly limit interruptions in CPR during deployment and removal of the device (Class IIb, LOE C-EO).
- Although several observational studies have been published documenting the use of ECPR, no randomized controlled trials have evaluated the effect of this therapy on survival.

Knowledge Gaps

- Are mechanical chest compression devices superior to manual chest compressions in special situations such as a moving ambulance, prolonged CPR, or procedures such as coronary angiography?
- What is the impact of implementing ECPR as part of the system of care for OHCA?

Part 7: Adult Advanced Cardiovascular Life Support

The major changes in the 2015 advanced cardiovascular life support (ACLS) guidelines include recommendations regarding prognostication during CPR based on end-tidal carbon dioxide measurements, use of vasopressin during resuscitation, timing of epinephrine administration stratified by shockable or nonshockable rhythms, and the possibility of bundling steroids, vasopressin, and epinephrine administration for treatment of IHCA. In addition, vasopressin has been removed from the pulseless arrest algorithm. Recommendations regarding physiologic monitoring of CPR were reviewed, although there is little new evidence.

Significant New and Updated Recommendations

- Based on new data, the recommendation for use of the maximal feasible inspired oxygen during CPR was strengthened. This recommendation applies only while CPR is ongoing and does not apply to care after ROSC.
- The new 2015 Guidelines Update continues to state that physiologic monitoring during CPR may be useful, but there has yet to be a clinical trial demonstrating that goal-directed CPR based on physiologic parameters improves outcomes.
- Recommendations for ultrasound use during cardiac arrest are largely unchanged, except for the explicit proviso that the use of ultrasound should not interfere with provision of high-quality CPR and conventional ACLS therapy.
- Continuous waveform capnography remained a Class I recommendation for confirming placement of an endotracheal tube. Ultrasound was added as an additional method for confirmation of endotracheal tube placement.
- The defibrillation strategies addressed by the 2015 ILCOR review resulted in minimal changes in defibrillation recommendations.
- The Class of Recommendation for use of standard dose epinephrine (1 mg every 3 to 5 minutes) was unchanged but reinforced by a single new prospective randomized clinical trial demonstrating improved ROSC and survival to hospital admission that was inadequately powered to measure impact on long-term outcomes.
- Vasopressin was removed from the ACLS Cardiac Arrest Algorithm as a vasopressor therapy in recognition of equivalence of effect with other available interventions (eg, epinephrine). This modification valued the simplicity of approach toward cardiac arrest when 2 therapies were found to be equivalent.
- The recommendations for timing of epinephrine administration were updated and stratified based on the initial presenting rhythm, recognizing the potential difference in pathophysiologic disease. For those with a nonshockable rhythm, it may be reasonable to administer epinephrine as soon as feasible. For those with a shockable rhythm, there is insufficient evidence to make a recommendation

about the optimal timing of epinephrine administration, because defibrillation is a major focus of resuscitation.
- The use of steroids in cardiac arrest is controversial. In OHCA, administration of steroids did not improve survival to hospital discharge in 2 studies, and routine use is of uncertain benefit. The data regarding the use of steroids for IHCA were more vexing. In 2 randomized controlled trials led by the same investigators, a pharmacologic bundle that included methylprednisolone, vasopressin, and epinephrine administered during cardiac arrest followed by hydrocortisone given after ROSC improved survival. Whether the improved survival was a result of the bundle or of the steroid therapy alone could not be assessed. As a result of this study, in IHCA, the combination of intra-arrest vasopressin, epinephrine, and methylprednisolone and postarrest hydrocortisone as described by Mentzelopoulos et al[16] may be considered; however, further studies are needed before the routine use of this therapeutic strategy can be recommended (Class IIb, LOE C-LD).
- Prognostication during CPR was also a very active topic. There were reasonably good data indicating that low partial pressure of end-tidal carbon dioxide ($PETCO_2$) in intubated patients after 20 minutes of CPR is strongly associated with failure of resuscitation. Importantly, this parameter should not be used in isolation and should not be used in nonintubated patients.
- ECPR, also known as venoarterial extracorporeal membrane oxygenation, may be considered as an alternative to conventional CPR for select patients with refractory cardiac arrest when the suspected etiology of the cardiac arrest is potentially reversible during a limited period of mechanical cardiorespiratory support.

Knowledge Gaps

- More knowledge is needed about the impact on survival and neurologic outcome when physiologic targets and ultrasound are used to guide resuscitation during cardiac arrest.
- The dose-response curve for defibrillation of shockable rhythms is unknown, and the initial shock energy, subsequent shock energies, and maximum shock energies for each waveform are unknown.
- More information is needed to identify the ideal current delivery to the myocardium that will result in defibrillation, and the optimal way to deliver it. The selected energy is a poor comparator for assessing different waveforms, because impedance compensation and subtleties in waveform shape result in a different transmyocardial current among devices at any given selected energy.
- Is a hands-on defibrillation strategy with ongoing chest compressions superior to current hands-off strategies with pauses for defibrillation?
- What is the dose-response effect of epinephrine during cardiac arrest?
- The efficacy of bundled treatments, such as epinephrine, vasopressin, and steroids, should be evaluated, and further studies are warranted as to whether the bundle with synergistic effects or a single agent is related to any observed treatment effect.
- There are no randomized trials for any antiarrhythmic drug as a second-line agent for refractory ventricular fibrillation/pulseless ventricular tachycardia, and there are no trials evaluating the initiation or continuation of antiarrhythmics in the post–cardiac arrest period.
- Controlled clinical trials are needed to assess the clinical benefits of ECPR versus traditional CPR for patients with refractory cardiac arrest and to determine which populations would most benefit.

When ROSC is not rapidly achieved after cardiac arrest, several options exist to provide prolonged circulatory support. These options include mechanical CPR devices, and use of endovascular ventricular assist devices, intra-aortic balloon counterpulsation, and ECPR have all been described. The role of these modalities, alone or in combination, is not well understood. (For additional information, see “Part 6: Alternative Techniques and Ancillary Devices for Cardiopulmonary Resuscitation.”)

Part 8: Post–Cardiac Arrest Care

Post–cardiac arrest care research has advanced significantly over the past decade. Multiple studies and trials detail the heterogeneity of patients and the spectrum of pathophysiology after cardiac arrest. Post–cardiac arrest care should be titrated based on arrest etiology, comorbid disease, and illness severity. Thus, the 2015 Guidelines Update integrates available data to help experienced clinicians make the complex set of therapeutic decisions required for these patients. The central principles of postarrest care are (1) to identify and treat the underlying etiology of the cardiac arrest, (2) to mitigate ischemia-reperfusion injury and prevent secondary organ injury, and (3) to make accurate estimates of prognosis to guide the clinical team and to inform the family when selecting goals of continued care.

New Developments

Early coronary angiography and coronary intervention are recommended for patients with ST elevation as well as for patients without ST elevation, when an acute coronary event is suspected. The decision to perform coronary angiography should not include consideration of neurologic status, because of the unreliability of early prognostic signs. Targeted temperature management is still recommended for at least 24 hours in comatose patients after cardiac arrest, but clinicians may choose a target temperature from the wider range of 32°C to 36°C. Estimating the prognosis of patients after cardiac arrest is best accomplished by using multiple modalities of testing: clinical examination, neurophysiological testing, and imaging.

Significant New and Updated Recommendations

One of the most common causes of cardiac arrest outside of the hospital is acute coronary occlusion. Quickly identifying and treating this cause is associated with better survival and better functional recovery. Therefore, coronary angiography should be performed emergently (rather than later in the hospital stay or not at all) for OHCA patients with suspected cardiac etiology of arrest and ST elevation on ECG. Emergency coronary angiography is reasonable for select (eg, electrically or hemodynamically unstable) adults who are without ST elevation on ECG but are comatose after OHCA of suspected cardiac origin. Emergency coronary angiography is also reasonable for post–cardiac arrest patients for whom coronary angiography is indicated, regardless of whether the patient is comatose or awake.

- A high-quality randomized controlled trial did not identify any superiority of targeted temperature management at 36°C compared with management at 33°C. Excellent outcomes are possible when patients are actively managed at either temperature. All comatose (ie, lack of meaningful response to verbal commands) adult patients with ROSC after cardiac arrest should have targeted temperature management, with providers selecting and maintaining a constant temperature between 32°C and 36°C for at least 24 hours after achieving target temperature. It is also reasonable to actively prevent fever in comatose patients after targeted temperature management.
- Multiple randomized controlled trials tested prehospital infusion of cold intravenous fluids to initiate hypothermia after OHCA. The absence of any benefit and the presence of some complications in these trials led to a recommendation against the routine prehospital cooling of patients after ROSC by using rapid infusion of cold saline. However, this recommendation does not preclude the use of cold intravenous fluids in more controlled or more selected settings and did not address other methods of inducing hypothermia.
- Specific management of patients during postresuscitation intensive care includes avoiding and immediately correcting hypotension and hypoxemia. It is reasonable to use the highest available oxygen concentration until the arterial oxyhemoglobin saturation or the partial pressure of arterial oxygen can be measured. However, the benefits of any specific target ranges for blood pressure, ventilator management, or glucose management are uncertain.
- Multiple studies examined methods to determine prognosis in patients after cardiac arrest, and the use of multiple modalities of testing is recommended. The earliest time to prognosticate a poor neurologic outcome by using clinical examination in patients *not* treated with targeted temperature management is 72 hours after ROSC, but this time can be even longer after cardiac arrest if the residual effect of sedation or paralysis is suspected to confound the clinical examination. In patients treated *with* targeted temperature management, where sedation or paralysis could confound clinical examination, it is reasonable to wait until 72 hours after return to normothermia.
- Useful clinical findings that are associated with poor neurologic outcome include
  - The absence of pupillary reflex to light at ≥72 hours after cardiac arrest
  - The presence of status myoclonus during the first 72 hours after cardiac arrest
  - The absence of the N20 somatosensory evoked potential cortical wave 24 to 72 hours after cardiac arrest or after rewarming
  - The presence of a marked reduction of the gray-white ratio on brain computed tomography obtained within 2 hours after cardiac arrest
  - Extensive restriction of diffusion on brain magnetic resonance imaging at 2 to 6 days after cardiac arrest
  - Persistent absence of electroencephalographic reactivity to external stimuli at 72 hours after cardiac arrest
  - Persistent burst suppression or intractable status epilepticus on electroencephalogram after rewarming
  - *Note:* Absent motor movements, extensor posturing or myoclonus should not be used alone for predicting outcome.
- All patients who are resuscitated from cardiac arrest but who subsequently progress to death or brain death should be evaluated as potential organ donors. Patients who do not have ROSC after resuscitation efforts also may be considered candidates as kidney or liver donors in settings where programs exist.

Knowledge Gaps

- Which post–cardiac arrest patients without ST elevation are most likely to benefit from early coronary angiography?
- What are the optimal goals for blood pressure, ventilation, and oxygenation in specific groups of post–cardiac arrest patients?
- What are the optimal duration, timing, and methods for targeted temperature management?
- Will particular subgroups of patients benefit from management at specific temperatures?
- What strategies can be used to prevent or treat post–cardiac arrest cerebral edema and malignant electroencephalographic patterns (seizures, status myoclonus)?
- What is the most reliable strategy for prognostication of futility in comatose post–cardiac arrest survivors?

Part 9: Acute Coronary Syndromes

The 2015 Guidelines Update newly limits recommendations for the evaluation and management of acute coronary syndromes (ACS) to the care rendered during the prehospital and emergency department phases of care only, and specifically does not address management of patients after emergency department disposition. Within this scope, several important components of care can be classified as diagnostic interventions in ACS, therapeutic interventions in ACS, reperfusion decisions in ST-segment elevation myocardial infarction (STEMI), and hospital reperfusion decisions after ROSC. Diagnosis is focused on ECG acquisition and interpretation and the rapid identification of patients with chest pain who are safe for discharge from the emergency department. Therapeutic interventions focus on prehospital adenosine diphosphate receptor antagonists in STEMI, prehospital anticoagulation, and the use of supplementary oxygen. Reperfusion decisions include when and where to use fibrinolysis versus percutaneous coronary intervention (PCI) and when post-ROSC patients may benefit from having access to PCI.

Significant New and Updated Recommendations

A well-organized approach to STEMI care still requires integration of community, EMS, physician, and hospital resources in a bundled STEMI system of care. Two studies published since the 2010 evidence review confirm the importance of acquiring a 12-lead ECG for patients with possible ACS as early as possible in the prehospital setting. These studies reaffirmed previous recommendations that when STEMI is diagnosed in the prehospital setting, prearrival notification of the hospital and/or prehospital activation of the catheterization laboratory should occur without delay. These updated recommendations place new emphasis on obtaining a prehospital ECG and on both the necessity for and the timing of receiving hospital notification.

- A prehospital 12-lead ECG should be acquired early for patients with possible ACS (Class I, LOE B-NR).
- Prehospital notification of the hospital (if fibrinolysis is the likely reperfusion strategy) and/or prehospital activation of the catheterization laboratory should occur for all patients with a recognized STEMI on prehospital ECG (Class I, LOE B-NR).

Because the rate of false-negative results of 12-lead ECGs may be unacceptably high, a computer reading of the ECG should not be a sole means to diagnose STEMI, but may be used in conjunction with physician or trained provider interpretation. New studies examining the accuracy of ECG interpretation by trained nonphysicians have prompted a revision of the recommendation to explicitly permit trained nonphysicians to interpret ECGs for the presence of STEMI.

- We recommend that computer-assisted ECG interpretation may be used in conjunction with physician or trained provider interpretation to recognize STEMI (Class IIb, LOE C-LD).
- While transmission of the prehospital ECG to the ED physician may improve the positive predictive value (PPV) and therapeutic decision making regarding adult patients with suspected STEMI, if transmission is not performed, it may be reasonable for trained nonphysician ECG interpretation to be used as the basis for decision making, including activation of the catheterization laboratory, administration of fibrinolysis, and selection of destination hospital. (Class IIa, LOE B-NR).

High-sensitivity cardiac troponin is now widely available. The 2015 CoSTR review examined whether a negative troponin test could reliably exclude a diagnosis of ACS in patients who did not have signs of STEMI on ECG. For emergency department patients with a presenting complaint consistent with ACS, high-sensitivity cardiac troponin T (hs-cTnT) and cardiac troponin I (cTnI) measured at 0 and 2 hours should not be interpreted in isolation (without performing clinical risk stratification) to exclude the diagnosis of ACS. In contrast, high-sensitivity cardiac troponin I (hs-cTnI), cTnI, or cardiac troponin T (cTnT) may be used in conjunction with a number of clinical scoring systems to identify patients at low risk for 30-day major adverse cardiac events (MACE) who may be safely discharged from the emergency department.

- We recommend that hs-cTnI measurements that are less than the 99th percentile, measured at 0 and 2 hours, may be used together with low risk stratification (Thrombolysis in Myocardial Infarction [TIMI] score of 0 or 1) to predict a less-than-1% chance of 30-day MACE (Class IIa, LOE B-NR).
- We recommend that negative cTnI or cTnT measurements at 0 and between 3 and 6 hours may be used together with very low risk stratification (Vancouver score of 0 or North American Chest Pain score of 0 and age less than 50 years) to predict a less-than-1% chance of 30-day MACE (Class IIa, LOE B-NR).

New recommendations have been made regarding several therapeutic interventions in ACS. New data from a case-control study that compared heparin and aspirin administered in the prehospital to the hospital setting found blood flow rates to be higher in infarct-related arteries when heparin and aspirin are administered in the prehospital setting. Because of the logistical difficulties in introducing heparin to EMS systems that do not currently use this drug and the limitations in interpreting data from a single study, initiation of adenosine diphosphate (ADP) inhibition may be reasonable in either the prehospital or the hospital setting in patients with suspected STEMI who intend to undergo primary PCI.

- We recommend that EMS systems that do not currently administer heparin to suspected STEMI patients not add this treatment, whereas those that do administer it may continue their current practice (Class IIb, LOE B-NR).
- In suspected STEMI patients for whom there is a planned primary PCI reperfusion strategy, administration of unfractionated heparin can occur either in the prehospital or the in-hospital setting (Class IIb, LOE B-NR).

Supplementary oxygen has been routinely administered to patients with suspected ACS for years. Despite this tradition, the usefulness of supplementary oxygen therapy has not been established in normoxemic patients.

- The usefulness of supplementary oxygen therapy has not been established in normoxic patients. In the prehospital, emergency department, and hospital settings, the withholding of supplementary oxygen therapy in normoxemic patients with suspected or confirmed ACS may be considered (Class IIb, LOE C-LD).

Timely restoration of blood flow to ischemic myocardium in acute STEMI remains the highest treatment priority. While the Class of Recommendation regarding reperfusion strategies remains unchanged from 2010, the choice between fibrinolysis and PCI has been reexamined to focus on clinical circumstances, system capabilities, and timing, and the recommendations have been updated accordingly. The anticipated time to PCI has been newly examined in 2015, and new time-dependent recommendations regarding the most effective reperfusion strategy are made. In STEMI patients, when long delays to primary PCI are anticipated (more than 120 minutes), a strategy of immediate fibrinolysis followed by routine early angiography (within 3 to 24 hours) and PCI, if indicated, is reasonable. It is acknowledged that fibrinolysis becomes significantly less effective at more than 6 hours after symptom onset, and thus a longer delay to primary PCI is acceptable in patients at more than 6 hours after symptom onset. To facilitate ideal treatment, systems of care must factor information about hospital capabilities into EMS destination decisions and interfaculty transfers.

- In adult patients presenting with STEMI in the emergency department (ED) of a non–PCI-capable hospital, we recommend immediate transfer without fibrinolysis from the initial facility to a PCI center instead of immediate fibrinolysis at the initial hospital with transfer only for ischemia-driven PCI (Class I, LOE B-R).
- When STEMI patients cannot be transferred to a PCI-capable hospital in a timely manner, fibrinolytic therapy with routine transfer for angiography may be an acceptable alternative to immediate transfer to primary PCI (Class IIb, LOE C-LD).
- When fibrinolytic therapy is administered to STEMI patients in a non–PCI-capable hospital, it may be reasonable to transport all postfibrinolysis patients for early routine angiography in the first 3 to 6 hours and up to 24 hours rather than transport postfibrinolysis patients only when they require ischemia-guided angiography (Class IIb, LOE B-R).

Knowledge Gaps

- More knowledge is needed about the optimal diagnostic approach for patients with serial troponin levels lower than the 99th percentile who are identified as being at moderate or high risk based on clinical scoring rules.
- The role of a single troponin measurement in identifying patients who are safe for discharge from the emergency department is currently evolving.
- The time from symptom onset to first medical contact is highly variable. An ideal reperfusion strategy considering the contribution of this variability in time to presentation has yet to be determined.

Part 10: Special Circumstances of Resuscitation

"Part 10: Special Circumstances of Resuscitation" presents new guidelines for the prevention and management of resuscitation emergencies related to opioid toxicity, and for the role of intravenous lipid emulsion (ILE) therapy for treatment of cardiac arrest due to drug overdose. Updated guidelines for the management of cardiac arrest occurring during the second half of pregnancy, cardiac arrest caused by pulmonary embolism, and cardiac arrest occurring during PCI are included.

Significant New and Updated Recommendations

- The 2010 Guidelines included a Class I recommendation to perform bag-mask–assisted ventilation and administer naloxone for patients with known or suspected opioid overdose who have respiratory depression but are not in cardiac arrest. Since that time, significant experience has accumulated to show that naloxone can be administered with apparent safety and effectiveness in the first aid and BLS settings. Accordingly, the 2015 Guidelines Update contains new recommendations for naloxone administration by non–healthcare providers, with recommendations for simplified training. A new algorithm for management of unresponsive victims with suspected opioid overdose is provided.
- Administration of ILE for the treatment of local anesthetic systemic toxicity (LAST), particularly from bupivacaine, is supported by extensive animal research and human case reports. In the 2015 Guidelines Update, this science was reviewed and a weak recommendation supporting use of ILE for treatment of LAST was reaffirmed. Since 2010, animal studies and human case reports have been published that examined the use of ILE for patients with other forms of drug toxicity, with mixed results. The 2015 Guidelines Update contains a new recommendation that ILE may be considered in patients with cardiac arrest due to drug toxicity other than LAST who are failing standard resuscitative measures.
- Relief of aortocaval compression has long been recognized as an essential component of resuscitation for women who develop cardiac arrest in the latter half of pregnancy, and this remains an important area of emphasis in the Guidelines. In the 2010 Guidelines, relief of aortocaval compression with manual left uterine displacement was a Class IIb recommendation. Although no cardiac arrest outcome studies have been published that compared left uterine displacement to other strategies to relieve aortocaval compression during CPR, the critical importance of high-quality CPR has been further supported. Because alternative strategies to relieve aortocaval compression (eg, lateral tilt) do not seem to be compatible with delivery of high-quality CPR, the recommendation to perform left uterine displacement during CPR was strengthened. If the fundus height is at or above the level of the umbilicus, manual left uterine displacement can be beneficial in relieving aortocaval compression during chest compressions (Class IIa, LOE C-LD).
- In addition to providing the opportunity for separate resuscitation of a potentially viable fetus, perimortem cesarean delivery (PMCD) provides the ultimate relief of aortocaval compression and may improve maternal resuscitation outcomes. The 2010 Guidelines included a Class IIb recommendation to consider performing PMCD at 4 to 5 minutes after the onset of maternal cardiac arrest without ROSC. The 2015 Guidelines Update expands on these recommendations. In situations such as nonsurvivable maternal trauma or prolonged maternal pulselessness, in which maternal resuscitative efforts are obviously futile, there is no reason to delay performing PMCD (Class I, LOE C-LD). PMCD should be considered at 4 minutes after the onset of maternal cardiac arrest or resuscitative efforts (for the unwitnessed arrest) if there is no ROSC (Class IIa, LOE C-EO). The complexity and need for clinical judgment in this decision making is explicitly acknowledged.

Knowledge Gaps

- Although the recommendation to consider PMCD after 4 minutes of unsuccessful maternal resuscitation attempts has been promulgated since 1986, it is based on scientific rationale rather than experimental evidence or critical analysis of prospectively collected data. A recent systematic review found that early time to PMCD (less than 10 minutes) was associated with improved survival of the mother but not of the child, and PMCD within 4 to 5 minutes may not be achievable in most settings. Although clinical trials are not feasible, large registry studies may be able to support evidence-based decision making in timing of PMCD to improve both maternal and neonatal outcomes.

- Since the first animal studies were published in 1998, a large body of literature has developed that describes the use of ILE in resuscitation from poisoning and drug toxicity. Although the experimental studies and human anecdotal reports are consistently positive for treatment of LAST from bupivacaine, more variable results are reported for treatment of LAST from other agents, and results achieved after ILE administration for other toxicants are mixed. Administration of ILE alters the effectiveness of epinephrine and vasopressin in animal resuscitation studies, may increase the absorption of lipophilic medications from the gastrointestinal tract, and sometimes interferes with the operation of venoarterial extracorporeal membrane oxygenation circuits. Further research is needed to determine the role of ILE in the management of cardiac arrest and refractory shock due to poisoning.

Part 11: Pediatric Basic Life Support and Cardiopulmonary Resuscitation Quality

The 2015 Guidelines Update for pediatric BLS concentrated on modifications in the algorithms for lone- and 2-rescuer CPR, initial actions of rescuers, and CPR quality process measures. Algorithms for 1- and 2-person healthcare provider CPR have been separated to better guide rescuers through the initial stages of resuscitation. In an era where handheld cellular telephones with speakers are common, this technology can allow a single rescuer to activate the emergency response system while beginning CPR. Healthcare providers should perform an assessment of breathing and pulse check simultaneously, to minimize delays in starting CPR if the child is unresponsive with no breathing or only gasping.

Significant New and Updated Recommendations

The 3 major CPR process characteristics that were evaluated included C-A-B (Compressions, Airway, Breathing) versus A-B-C (Airway, Breathing, Compressions), compression-only CPR, and compression depth and rate. No major changes were made for the 2015 Guidelines Update; however, new concepts in CPR delivery were examined for children.

- Because of the limited amount and quality of the data, it may be reasonable to maintain the sequence from the 2010 Guidelines by initiating CPR with C-A-B over A-B-C (Class IIb, LOE C-EO). There are no pediatric human studies to evaluate C-A-B versus A-B-C, but manikin studies do demonstrate a shorter time to first chest compression. This recommendation was made to simplify training, provide consistency for teaching rescuers of adults and children, and hopefully increase the number of victims who receive bystander CPR.
- Compression depth of at least one third of the anterior-posterior diameter, approximately 1.5 inches (4 cm) for infants and approximately 2 inches (5 cm) for children, was affirmed (Updated). The Class of Recommendation was downgraded from Class I to Class IIa, primarily based on the rigor of the evidence evaluation. There are limited clinical data on the effect of compression depth on resuscitation outcomes, but 2 clinical studies suggest that compression depth is also associated with survival.
- Compression rate was not reviewed because of insufficient evidence, and we recommend that rescuers use the adult rate of 100 to 120/min (Updated).
- The asphyxial nature of the majority of pediatric cardiac arrests necessitates ventilation as part of effective CPR, and 2 large database studies documented worse 30-day outcomes with compression-only CPR compared with conventional CPR. For this reason, conventional CPR (chest compressions and rescue breaths) is a Class I recommendation (LOE B-NR) for children. However, because compression-only CPR is effective in patients with a primary cardiac event, if rescuers are unwilling or unable to deliver breaths, we recommend rescuers perform compression-only CPR for infants and children in cardiac arrest (Class I, LOE B-NR). Conventional CPR (chest compressions and rescue breaths) is a Class I recommendation (LOE B-NR).

Knowledge Gaps

- Much of the data supporting pediatric BLS is primarily extrapolated from studies in adults. Multicenter pediatric studies from both in-hospital and out-of-hospital arrest are needed to optimize outcomes for children.
- More knowledge is needed about the optimal sequence, feedback techniques and devices, and effect of different surfaces on CPR delivery in children.

Part 12: Pediatric Advanced Life Support

Significant New and Updated Recommendations

The following are the most important changes and reinforcements to recommendations made in the 2010 Guidelines:

- There is new evidence that when treating pediatric septic shock in specific settings, the use of restricted volume of isotonic crystalloid leads to improved survival, contrasting with the long-standing belief that all patients benefit from aggressive volume resuscitation. New guidelines suggest a cautious approach to fluid resuscitation, with frequent patient reassessment, to better tailor fluid therapy and supportive care to children with febrile illness.
- New literature suggests limited survival benefit to the routine use of atropine as a premedication for emergency tracheal intubation of non-neonates, and that any benefit in preventing arrhythmias is controversial. Recent literature also provides new evidence suggesting there is no minimum dose required for atropine use.
- Children in cardiac arrest may benefit from the titration of CPR to blood pressure targets, but this strategy is suggested only if they already have invasive blood pressure monitoring in place.

- New evidence suggests that either amiodarone *or* lidocaine is acceptable for treatment of shock-refractory pediatric ventricular fibrillation and pulseless ventricular tachycardia.
- Recent literature supports the need to avoid fever when caring for children remaining unconscious after OHCA.
- The writing group reviewed a newly published multicenter clinical trial of targeted temperature management that demonstrated that a period of either 2 days of moderate therapeutic hypothermia (32° to 34° C) or the strict maintenance of normothermia (36° to 37.5° C) were equally beneficial. As a result, the writing group feels either of these approaches is appropriate for infants and children remaining comatose after OHCA.
- Hemodynamic instability after cardiac arrest should be treated actively with fluids and/or inotropes/vasopressors to maintain systolic blood pressure greater than the fifth percentile for age. Continuous arterial pressure monitoring should be used when the appropriate resources are available.

Knowledge Gaps

- What clinical or physiologic parameters reflect high-quality pediatric CPR and improve outcome in children? Do devices to monitor these parameters improve survival?
- What is the role of targeted temperature management in the care of children who remain unconscious after *in-hospital* cardiac arrest?
- Does a postarrest bundle of care with specific targets for temperature, oxygenation and ventilation, and hemodynamic parameters improve outcomes after pediatric cardiac arrest?
- Does a combination of intra-arrest factors reliably predict successful resuscitation in children with either OHCA or IHCA?

Part 13: Neonatal Resuscitation

"Part 13: Neonatal Resuscitation" presents new guidelines for resuscitation of primarily newly born infants transitioning from intrauterine to extrauterine life. The recommendations are also applicable to neonates who have completed newborn transition and require resuscitation during the first weeks after birth.

Much of the neonatal resuscitation guidelines remains unchanged from 2010, but there is increasing focus on umbilical cord management, maintaining a normal temperature after birth, accurate determination of heart rate, optimizing oxygen use during resuscitation, and de-emphasis of routine suctioning for meconium in nonvigorous newborns. The etiology of neonatal arrest is almost always asphyxia, and therefore, establishing effective ventilation remains the most critical step.

Significant New and Updated Recommendations

Umbilical cord management: The 2015 Guidelines Update includes for the first time recommendations regarding umbilical cord management. Until recently, it was common practice to clamp the umbilical cord immediately after birth to facilitate rapid transfer of the baby to the pediatric provider for stabilization. A significant issue with the available evidence is that the published studies enrolled very few babies who were considered to need resuscitation.

- There is evidence, primarily in babies who do not require resuscitation, that delayed cord clamping is associated with less intraventricular hemorrhage, higher blood pressure and blood volume, less need for transfusion after birth, and less necrotizing enterocolitis. Delayed cord clamping conferred no benefit on mortality or severe intraventricular hemorrhage. The only negative consequence seems to be a slightly increased level of bilirubin, associated with more need for phototherapy.[17,18]
- Delayed cord clamping for longer than 30 seconds is reasonable for both term and preterm infants who do not require resuscitation at birth (Class IIa, LOE C-LD). There is still insufficient evidence to recommend an approach to cord clamping or cord "milking" for babies who require resuscitation at birth.

Assessment of heart rate: Immediately after birth, assessment of the newborn's heart rate is used to evaluate the effectiveness of spontaneous respiratory effort and determine the need for subsequent interventions. An increase in the newborn's heart rate is considered the most sensitive indicator of a successful response to resuscitation interventions. Therefore, identifying a rapid, reliable, and accurate method to measure the newborn's heart rate is critically important.

- Available evidence comparing clinical assessment with ECG in the delivery room and simultaneous pulse oximetry and ECG heart rate determination found that clinical assessment was both unreliable and inaccurate.
- ECG (3-lead) displayed a reliable heart rate faster than pulse oximetry. Pulse oximetry tended to underestimate the newborn's heart rate and would have led to potentially unnecessary interventions.[17,18]
- During resuscitation of term and preterm newborns, the use of 3-lead ECG for the rapid and accurate measurement of the newborn's heart rate may be reasonable (Class IIb, LOE C-LD).

Maintaining normal temperature of the newborn after birth: It is recommended that the temperature of newly born nonasphyxiated infants be maintained between 36.5°C and 37.5°C after birth through admission and stabilization (Class I, LOE C-LD).[15] There is new evidence supporting a variety of interventions that may be used alone or in combination to reduce hypothermia. Temperature must be monitored to avoid hyperthermia as well.

Management of the meconium stained infant: For more than a decade, vigorous infants born through meconium stained amniotic fluid have been treated no differently than if they had been born through clear fluid. However, there remained a long standing practice to intubate and suction infants born through meconium stained amniotic fluid who have poor muscle tone and inadequate breathing efforts at birth.

- Routine intubation for tracheal suction in this setting is not suggested because there is insufficient evidence to continue recommending this practice (Class IIb, LOE C-LD).[17,18]

- In making this suggested change, greater value has been placed on harm avoidance (delays in providing positive-pressure ventilation, potential harm of the procedure) over the unknown benefit of the intervention of routine trachea intubation and suctioning.

Oxygen use for preterm infants in the delivery room: Since the release of the 2010 Guidelines, additional randomized trials have been published that examine the use of oxygen during resuscitation and stabilization of preterm newborns. These additional publications have allowed an increase from Class IIb to a Class I recommendation.

- Meta-analysis of the randomized trials that compared initiating resuscitation of preterm newborns (less than 35 weeks of gestation) with high oxygen (65% or greater) versus low oxygen (21%–30%) showed no improvement in survival or morbidity to hospital discharge with the use of high oxygen.[17,18]
- Resuscitation of preterm newborns of less than 35 weeks of gestation should be initiated with low oxygen (21%–30%), and the oxygen concentration should be titrated to achieve preductal oxygen saturation approximating the interquartile range measured in healthy term infants after vaginal birth at sea level (Class I, LOE B-R). This recommendation reflects a preference for not exposing preterm newborns to additional oxygen without data demonstrating a proven benefit for important outcomes.

Oxygen use during neonatal cardiac compressions: The evidence for optimal oxygen use during neonatal cardiac compressions was not reviewed for the 2010 Guidelines. Unfortunately, there are no clinical studies to inform the neonatal guidelines, but the available animal evidence demonstrated no obvious advantage of 100% oxygen over air. However, by the time resuscitation of a newborn includes cardiac compressions, the steps of trying to improve the heart rate via effective ventilation with low concentrations of oxygen should have already been tried. Thus, the 2015 Guidelines Task Force thought it was reasonable to increase the supplementary oxygen concentration during cardiac compressions and then subsequently wean the oxygen as soon as the heart rate recovers (see "Part 13: Neonatal Resuscitation" in this 2015 Guidelines Update).

Structure of educational programs to teach neonatal resuscitation: Currently, neonatal resuscitation training that includes simulation and debriefing is recommended at 2-year intervals.

- Studies that examined how frequently healthcare providers or healthcare students should train showed no differences in patient outcomes, but demonstrated some advantages in psychomotor performance, knowledge, and confidence when focused task training occurred every 6 months or more frequently.[17,18]
- It is therefore suggested that neonatal resuscitation task training occur more frequently than the current 2-year interval (Class IIb, LOE B-R, LOE C-EO, LOE C-LD).[15]

Knowledge Gaps

Umbilical cord management for newborns needing resuscitation: As noted previously, the risks and benefits of delayed cord clamping for newborns who need resuscitation after birth remains unknown because such infants have thus far been excluded from the majority of trials. Concern remains that delay in establishing ventilation may be harmful. Further study is strongly endorsed.

- Some studies have suggested that cord milking might accomplish goals similar to delayed cord clamping.[17,18] Cord milking is rapid and can be accomplished within 15 seconds, before resuscitation might ordinarily be initiated. However, there is insufficient evidence of either the safety or utility of cord milking in babies requiring resuscitation.
- The effect of delayed cord clamping or cord milking on initial heart rate and oxygen saturations is also unknown. New normal ranges may need to be determined.
- The risks and benefits of inflating the lungs to establish breathing before clamping of the umbilical cord needs to be explored.

Utility of a sustained inflation during the initial breaths after birth: Several recent animal studies suggested that a longer sustained inflation may be beneficial for establishing functional residual capacity during transition from fluid-filled to air-filled lungs after birth. Some clinicians have suggested applying this technique for transition of human newborns.

- It was the consensus of the 2015 CoSTR and the 2015 Guidelines Task Force that there was inadequate study of the benefits and risks to recommend sustained inflation at this time. Further study using carefully designed protocols was endorsed (see "Part 13: Neonatal Resuscitation" in this 2015 Guidelines Update and Perlman et al[17,18]).

Determination of heart rate: Neonatal resuscitation success has classically been determined by detecting an increase in heart rate through auscultation. Heart rate also determines the need for changing interventions and escalating care. However, recent evidence demonstrates that auscultation of heart rate is inaccurate, and pulse oximetry takes several minutes to achieve a signal and also may be inaccurate during the early minutes after birth. Use of ECG in the delivery room has been suggested as a possible alternative.

- Although data suggest that the ECG provides a more accurate heart rate in the first 3 minutes of life, there are no available data to determine how outcomes would change by acting (or not acting) on the information.
- Some transient bradycardia may be normal and be reflective of timing of cord clamping. More studies are needed.
- The human factors issues associated with introducing ECG leads in the delivery room are unknown.
- In addition, improved technologies for rapid application of ECG are needed.

Part 14: Education

There remains strikingly low survival rates for both OHCA and IHCA despite scientific advances in the care of cardiac arrest victims. The Formula for Survival suggests that cardiac arrest survival is influenced by high-quality science, education of lay providers and healthcare professionals, and a well-functioning Chain of Survival.[19] Considerable opportunities exist for education to close the gap between actual and desired performance of lay providers and healthcare teams. For lay providers, this includes proficient CPR and AED skills and the self-efficacy to use them, along with immediate support such as dispatch-guided CPR. For healthcare providers, the goals remain to recognize and respond to patients at risk of cardiac arrest, deliver high-quality CPR whenever CPR is required, and improve the entire resuscitation process through improved teamwork. Additionally, there needs to be a feedback loop focused on continuous quality improvement that can help the system improve as well as identify needs for targeted learning/performance improvement. Optimizing the knowledge translation of what is known from the science of resuscitation to the victim's bedside is a key step to potentially saving many more lives.

Evidence-based instructional design is essential to improve training of providers and ultimately improve resuscitation performance and patient outcomes. The quality of rescuer performance depends on learners integrating, retaining, and applying the cognitive, behavioral, and psychomotor skills required to successfully perform resuscitation. "Part 14: Education" provides an overview of the educational principles that the AHA has implemented to maximize learning from its educational programs. It is important to note that the systematic reviews from which the Guidelines were derived assigned a hierarchy of outcomes for educational studies that considered patient-related outcomes as "critical" and outcomes in educational settings as "important."

Significant New and Updated Recommendations

The key recommendations based on the systematic reviews include the following:

- The use of high-fidelity manikins for ALS training can be beneficial in programs that have the infrastructure, trained personnel, and resources to maintain the program. Standard manikins continue to be an appropriate choice for organizations that do not have this capacity.

Use of a CPR feedback device is recommended to learn the psychomotor skill of CPR. Devices that provide feedback on performance are preferred to devices that provide only prompts (such as a metronome). Instructors are not accurate at assessment of CPR quality by visual inspection, so an adjunctive tool is necessary to provide accurate guidance to learners developing these critical psychomotor skills. Improved manikins that better reflect patient characteristics may prove important for future training. Use of CPR quality feedback devices during CPR is reviewed in "Part 5: Adult Basic Life Support and CPR Quality."

- Two-year retraining cycles are not optimal. More frequent training of BLS and advanced life support skills may be helpful for providers likely to encounter a victim of cardiac arrest.
- Although prior CPR training is not required for potential rescuers to initiate CPR, training helps people learn the skills and develop the self-efficacy to provide CPR when necessary. BLS skills seem to be learned as well through self-instruction (video or computer based) with hands-on practice as with traditional instructor-led courses. The opportunity to train many more individuals to provide CPR while reducing the cost and resources required for training is important when considering the vast population of potential rescuers that should be trained.
- To reduce the time to defibrillation for cardiac arrest victims, the use of an AED should not be limited to trained individuals only (although training is still recommended). A combination of self-instruction and instructor-led teaching with hands-on training can be considered as an alternative to traditional instructor-led courses for lay providers.
- Precourse preparation, including review of appropriate content information, online/precourse testing, and/or practice of pertinent technical skills, may optimize learning from advanced life support courses.
- Given very small risk for harm and the potential benefit of team and leadership training, the inclusion of team and leadership training as part of ALS training is reasonable.
- Communities may consider training bystanders in compression-only CPR for adult OHCA as an alternative to training in conventional CPR.

Knowledge Gaps

- Research on resuscitation education needs higher-quality studies that address important educational questions. Outcomes from educational studies should focus on patient outcomes (where feasible), performance in the clinical environment, or at least long-term retention of psychomotor and behavioral skills in the simulated resuscitation environment. Too much of the current focus of educational research is on the immediate end-of-course performance, which may not be representative of participants' performance when they are faced with a resuscitation event months or years later. Assessment tools that have been empirically studied for evidence of validity and reliability are foundational to high-quality research. Standardizing the use of such tools across studies could potentially allow for meaningful comparisons when analyzing evidence in systematic reviews to more precisely determine the impact of certain interventions. Cost-effectiveness research is needed because many of the AHA education guidelines are developed in the absence of this information.
- The ideal methodology (ie, instructional design) and frequency of training required to enhance retention of skills and performance in simulated and actual resuscitations needs to be determined.

Part 15: First Aid

"Part 15: First Aid" reaffirms the definition of *first aid* as the helping behaviors and initial care provided for an acute illness or injury. The provision of first aid has been expanded to include any person, from layperson to professional healthcare provider, in a setting where first aid is needed. Goals and competencies are now provided to give guidance and perspective beyond specific skills. While a basic tenet of first aid is the delivery of care using minimal or no equipment, it is increasingly recognized that in some cases first aid providers may have access to various adjuncts, such as commercial tourniquets, glucometers, epinephrine autoinjectors, or oxygen. The use of any such equipment mandates training, practice, and, in some cases, medical or regulatory oversight related to use and maintenance of that equipment.

Although there is a growing body of observational studies performed in the first aid setting, most recommendations set forth in "Part 15: First Aid" continue to be extrapolated from prehospital- and hospital-based studies. One important new development relates to the ability of a first aid provider to recognize the signs and symptoms of acute stroke. "Part 15: First Aid" describes the various stroke assessment systems that are available to first aid providers, and lists their sensitivities and specificities in identifying stroke based on included components. This new recommendation for use of a stroke assessment system complements previous recommendations for early stroke management by improving the recognition of stroke signs and symptoms at the first step of emergency care—first aid—thus potentially reducing the interval from symptom onset to definitive care.

Significant New and Updated Recommendations

- Evidence shows that the early recognition of stroke by using a stroke assessment system decreases the interval between the time of stroke onset and arrival at a hospital and definitive treatment. More than 94% of lay providers trained in a stroke assessment system are able to recognize signs and symptoms of a stroke, and this ability persists at 3 months after training. The use of a stroke assessment system by first aid providers is recommended (Class I, LOE B-NR). Compared to stroke assessment systems without glucose measurement, assessment systems that include glucose measurement have similar sensitivity but higher specificity for recognition of stroke.
- Hypoglycemia is a condition that is commonly encountered by first aid providers. Severe hypoglycemia, which may present with loss of consciousness or seizures, typically requires management by EMS providers. If a person with diabetes reports low blood sugar or exhibits signs or symptoms of mild hypoglycemia and is able to follow simple commands and swallow, oral glucose should be given to attempt to resolve the hypoglycemia. Glucose tablets, if available, should be used to reverse hypoglycemia in a patient who is able to take these orally (Class I, LOE B-R). If glucose tablets are not available, other specifically evaluated forms of sucrose- and fructose-containing foods, liquids, and candy can be effective as an alternative to glucose tablets for reversal of mild symptomatic hypoglycemia.
- The first aid management of an open chest wound was evaluated for the 2015 ILCOR Consensus Conference. The improper use of an occlusive dressing or device with potential subsequent development of unrecognized tension pneumothorax is of great concern. There are no human studies comparing the application of an occlusive dressing to a nonocclusive dressing, and only a single animal study showed benefit to use of a nonocclusive dressing. As a result of the lack of evidence for use of an occlusive dressing and the risk of unrecognized tension pneumothorax, we recommend against the application of an occlusive dressing or device by first aid providers for an individual with an open chest wound.
- First aid providers often encounter individuals with a concussion (minor traumatic brain injury). The myriad of signs and symptoms of concussion can make recognition of this injury a challenge. Although a simple validated single-stage concussion scoring system could possibly help first aid providers in the recognition of concussion, there is no evidence to support the use of such a scoring system. There are sport concussion assessment tools for use by healthcare professionals that require a 2-stage assessment, before competition and after concussion, but these are not appropriate as a single assessment tool for first aid providers. Therefore, it is recommended that a healthcare provider evaluate as soon as possible any person with a head injury that has resulted in a change in level of consciousness, who has progressive development of signs or symptoms of a concussion or traumatic brain injury, or who is otherwise a cause for concern to the first aid provider.
- Dental avulsion can result in permanent loss of a tooth. Immediate reimplantation of the avulsed tooth is thought by the dental community to afford the greatest chance of tooth survival. First aid providers may not be able to reimplant an avulsed tooth because of lack of training, skill, or personal protective equipment, or they may be reluctant to perform a painful procedure. The storage of an avulsed tooth in a variety of solutions (compared with saliva or milk) has been shown to prolong viability of dental cells by 30 to 120 minutes. In situations that do not allow for immediate reimplantation, the temporary storage of an avulsed tooth in one of these solutions may afford time until the tooth can be reimplanted.
- Evidence shows that education in first aid can increase survival rates, improve recognition of acute illness, and resolve symptomatology. We recommend that first aid education be universally available (Class I, LOE C-EO).
- Past Guidelines recommended that first aid providers assist the person with symptoms of anaphylaxis to administer that person's epinephrine.[20] Evidence supports the need for a second dose of epinephrine for acute anaphylaxis in persons not responding to a first dose. When a person with anaphylaxis does not respond to the initial dose and arrival of advanced care will exceed 5 to 10 minutes, a repeat dose may be considered (Class IIb, LOE C-LD).
- There is no evidence of any benefit from routine administration of supplementary oxygen by first aid providers. Limited evidence shows benefit from use of oxygen for decompression sickness in the first aid setting. The use of supplementary oxygen by first aid providers with specific training (eg, a diving first aid oxygen course) is

reasonable for cases of decompression sickness. Limited evidence suggests that supplementary oxygen may be effective for relief of dyspnea in advanced lung cancer patients with dyspnea and associated hypoxia, but not for similar patients without hypoxia.

- Newer-generation hemostatic agent–impregnated dressings have been shown to cause fewer complications and adverse effects and are effective in providing hemostasis in up to 90% of subjects in case series. First aid providers may consider use of hemostatic dressings when standard bleeding control (with direct pressure) is not effective.
- The use of cervical collars as a component of spinal motion restriction for blunt trauma was reviewed for the 2015 ILCOR consensus. No evidence was identified that showed a decrease in neurologic injury with use of a cervical collar. Evidence demonstrates adverse effects from use of a cervical collar, such as increased intracranial pressure and potential airway compromise. The ILCOR First Aid Task Force also expressed concern that proper technique for application of a cervical collar in high-risk individuals requires significant training and practice to be performed correctly and is not considered a standard first aid skill. Because of these concerns, and with a growing body of evidence demonstrating harmful effects and no good evidence showing clear benefit, we recommend against routine application of cervical collars by first aid providers.

Knowledge Gaps

- Control of severe bleeding is a topic that has gained public interest and importance with recent domestic terrorist attacks. The ideal order for the technique of bleeding control by first aid providers for severe bleeding of an extremity is not clear—ie, direct pressure → tourniquet → additional (double) tourniquet; direct pressure → hemostatic dressing → tourniquet. It is also unclear how tourniquets compare with hemostatic dressings (or double tourniquet) for control of bleeding in extremity wounds.
- First aid providers may have difficulty recognizing potentially life-threatening conditions. The development and validation of highly sensitive assessment systems or scales (such as for stroke) and other educational techniques may help first aid providers recognize these entities so that they can provide rapid, appropriate care. Conditions that may benefit from development of such assessment educational systems include anaphylaxis, hypoglycemia, chest pain of cardiac origin, high-risk cervical spine injury, concussion, poisoning or overdose, abnormal versus normal breathing, and shock.
- How should a first aid provider care for a person with a potential spinal injury while awaiting arrival of EMS? Is there a benefit to manual cervical spinal stabilization by a first aid provider, and, if so, which technique is best? If verbal instructions to not move are given to a conscious/responsive person with trauma and possible spine injury, are they effective or useful?

Summary

The *2015 AHA Guidelines Update for CPR and ECC* incorporated the evidence from the systematic reviews completed as part of the 2015 International Consensus on CPR and ECC Science With Treatment Recommendations. This 2015 Guidelines Update marks the transition from periodic review and publication of new science-based recommendations to a more continuous process of evidence evaluation and guideline optimization designed to more rapidly translate new science into resuscitation practice that will save more lives. The Appendix to this Part contains a list of all recommendations published in the 2015 Guidelines Update and, in addition, lists the recommendations from the 2010 Guidelines. The 2015 recommendations were made consistent with the new AHA Classification System for describing the risk-benefit ratio for each Class and the Levels of Evidence supporting them. (Please see Figure 1 in "Part 2: Evidence Evaluation and Management of Conflicts of Interest.")

Survival from both IHCA and OHCA has increased over the past decade, but there is still tremendous potential for improvement. It is clear that successful resuscitation depends on coordinated systems of care that start with prompt rescuer actions, require delivery of high-quality CPR, and continue through optimized ACLS and post–cardiac arrest care. Systems that monitor and report quality-of-care metrics and patient-centered outcomes will have the greatest opportunity through quality improvement to save the most lives.

Disclosures

Part 1: Executive Summary: 2015 Guidelines Update Writing Group Disclosures

Writing Group Member	Employment	Research Grant	Other Research Support	Speakers' Bureau/ Honoraria	Expert Witness	Ownership Interest	Consultant/ Advisory Board	Other
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Part 1: Executive Summary: 2015 Guidelines Update Writing Group Disclosures, *Continued*

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This table represents the relationships of writing group members that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all members of the writing group are required to complete and submit. A relationship is considered to be "significant" if (a) the person receives $10 000 or more during any 12-month period, or 5% or more of the person's gross income; or (b) the person owns 5% or more of the voting stock or share of the entity, or owns $10 000 or more of the fair market value of the entity. A relationship is considered to be "modest" if it is less than "significant" under the preceding definition.

*Modest.

†Significant.

Appendix

2015 Guidelines Update: Master List of Recommendations

Year Last Reviewed	Topic	Recommendation	Comments
Part 3: Ethical Issues			
2015	The Use of Extracorporeal CPR in OHCA	There is insufficient evidence to recommend the routine use of ECPR for patients with cardiac arrest. In settings where it can be rapidly implemented, ECPR may be considered for select patients for whom the suspected etiology of the cardiac arrest is potentially reversible during a limited period of mechanical cardiorespiratory support (Class IIb, LOE C-LD).	new for 2015
2015	Intra-arrest Prognostic Factors for Cardiac Arrest in Infants and Children	Multiple variables should be used when attempting to prognosticate outcomes during cardiac arrest (Class I, LOE C-LD).	new for 2015
2015	The Use of a Prognostic Score in the Delivery Room for Preterm Infants	However, in individual cases, when counseling a family and constructing a prognosis for survival at gestations below 25 weeks, it is reasonable to consider variables such as perceived accuracy of gestational age assignment, the presence or absence of chorioamnionitis, and the level of care available for location of delivery. It is also recognized that decisions about appropriateness of resuscitation below 25 weeks of gestation will be influenced by region-specific guidelines. In making this statement, a higher value was placed on the lack of evidence for a generalized prospective approach to changing important outcomes over improved retrospective accuracy and locally validated counseling policies. The most useful data for antenatal counseling provides outcome figures for infants alive at the onset of labor, not only for those born alive or admitted to a neonatal intensive care unit (Class IIb, LOE C-LD)	new for 2015
2015	Terminating Resuscitative Efforts in Term Infants	We suggest that, in infants with an Apgar score of 0 after 10 minutes of resuscitation, if the heart rate remains undetectable, it may be reasonable to stop assisted ventilations; however, the decision to continue or discontinue resuscitative efforts must be individualized. Variables to be considered may include whether the resuscitation was considered optimal; availability of advanced neonatal care, such as therapeutic hypothermia; specific circumstances before delivery (eg, known timing of the insult); and wishes expressed by the family (Class IIb, LOE C-LD)	updated for 2015
2015	The Use of ECPR in IHCA	There is insufficient evidence to recommend the routine use of ECPR for patients with cardiac arrest. In settings where it can be rapidly implemented, ECPR may be considered for select cardiac arrest patients for whom the suspected etiology of the cardiac arrest is potentially reversible during a limited period of mechanical cardiorespiratory support. (Class IIb, LOE C-LD).	new for 2015
2015	The Use of ECPR in IHCA	ECPR may be considered for pediatric patients with cardiac diagnoses who have IHCA in settings with existing ECMO protocols, expertise, and equipment (Class IIb, LOE C-LD).	new for 2015
2015	Terminating Cardiac Arrest Resuscitative Efforts in Pediatric IHCA	Multiple variables should be used when attempting to prognosticate outcomes during cardiac arrest (Class I, LOE C-LD).	new for 2015
2015	Prognostication During CPR	In intubated patients, failure to achieve an $ETCO_2$ of greater than 10 mm Hg by waveform capnography after 20 minutes of CPR may be considered as one component of a multimodal approach to decide when to end resuscitative efforts but should not be used in isolation (Class IIb, LOE C-LD).	new for 2015

(*Continued*)

2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2015	Prognostication During CPR	In nonintubated patients, a specific $ETCO_2$ cutoff value at any time during CPR should not be used as an indication to end resuscitative efforts (Class III: Harm, LOE C-EO).	new for 2015
2015	Predictive Factors After Cardiac Arrest in Pediatric Patients	EEGs performed within the first 7 days after pediatric cardiac arrest may be considered in prognosticating neurologic outcome at the time of hospital discharge (Class IIb, LOE C-LD) but should not be used as the sole criterion.	new for 2015
2015	Predictive Factors After Cardiac Arrest in Pediatric Patients	The reliability of any 1 variable for prognostication in children after cardiac arrest has not been established. Practitioners should consider multiple factors when predicting outcomes in infants and children who achieve ROSC after cardiac arrest (Class I, LOE C-LD).	new for 2015
2015	Timing of Prognostication in Post–Cardiac Arrest Adults	The earliest time for prognostication in patients treated with TTM using clinical examination where sedation or paralysis could be a confounder may be 72 hours after return to normothermia (Class IIb, LOE C-EO).	updated for 2015
2015	Timing of Prognostication in Post–Cardiac Arrest Adults	We recommend the earliest time to prognosticate a poor neurologic outcome in patients not treated with TTM using clinical examination is 72 hours after cardiac arrest (Class I, LOE B-NR).	updated for 2015
2015	Timing of Prognostication in Post–Cardiac Arrest Adults	This time can be even longer after cardiac arrest if the residual effect of sedation or paralysis confounds the clinical examination (Class IIa, LOE C-LD).	new for 2015
2015	Prognostic Testing in Adult Patients After Cardiac Arrest: Clinical Exam Findings	In comatose patients who are not treated with TTM, the absence of pupillary reflex to light at 72 hours or more after cardiac arrest is a reasonable exam finding with which to predict poor neurologic outcome (FPR, 0%; 95% CI, 0%–8%; Class IIa, LOE B-NR).	new for 2015
2015	Prognostic Testing in Adult Patients After Cardiac Arrest: Clinical Exam Findings	In comatose patients who are treated with TTM, the absence of pupillary reflex to light at 72 hours or more after cardiac arrest is useful to predict poor neurologic outcome (FPR, 0%; 95% CI, 0%–3%; Class I, LOE B-NR).	new for 2015
2015	Prognostic Testing in Adult Patients After Cardiac Arrest: Clinical Exam Findings	We recommend that, given their high FPRs, the findings of either absent motor movements or extensor posturing should not be used alone for predicting a poor neurologic outcome (FPR, 10%; 95% CI, 7%–15% to FPR, 15%; 95% CI, 5%–31%; Class III: Harm, LOE B-NR).	new for 2015
2015	Prognostic Testing in Adult Patients After Cardiac Arrest: Clinical Exam Findings	The motor examination may be a reasonable means to identify the population who need further prognostic testing to predict poor outcome (Class IIb, LOE B-NR).	new for 2015
2015	Prognostic Testing in Adult Patients After Cardiac Arrest: Clinical Exam Findings	We recommend that the presence of myoclonus, which is distinct from status myoclonus, should not be used to predict poor neurologic outcomes because of the high FPR (FPR, 5%; 95% CI, 3%–8% to FPR, 11%; 95% CI, 3%–26%; Class III: Harm, LOE B-NR).	new for 2015
2015	Prognostic Testing in Adult Patients After Cardiac Arrest: Clinical Exam Findings	In combination with other diagnostic tests at 72 or more hours after cardiac arrest, the presence of status myoclonus during the first 72 hours after cardiac arrest is a reasonable finding to help predict poor neurologic outcomes (FPR, 0%; 95% CI, 0%–4%; Class IIa, LOE B-NR).	new for 2015
2015	Prognostic Testing in Adult Patients After Cardiac Arrest: EEG	In comatose post–cardiac arrest patients who are treated with TTM, it may be reasonable to consider persistent absence of EEG reactivity to external stimuli at 72 hours after cardiac arrest, and persistent burst suppression on EEG after rewarming, to predict a poor outcome (FPR, 0%; 95% CI, 0%–3%; Class IIb, LOE B-NR).	updated for 2015
2015	Prognostic Testing in Adult Patients After Cardiac Arrest: EEG	Intractable and persistent (more than 72 hours) status epilepticus in the absence of EEG reactivity to external stimuli may be reasonable to predict poor outcome (Class IIb, LOE B-NR).	updated for 2015
2015	Prognostic Testing in Adult Patients After Cardiac Arrest: EEG	In comatose post–cardiac arrest patients who are not treated with TTM, it may be reasonable to consider the presence of burst suppression on EEG at 72 hours or more after cardiac arrest, in combination with other predictors, to predict a poor neurologic outcome (FPR, 0%; 95% CI, 0%–11%; Class IIb, LOE B-NR).	updated for 2015
2015	Prognostic Testing in Adult Patients After Cardiac Arrest: Evoked Potentials	In patients who are comatose after resuscitation from cardiac arrest regardless of treatment with TTM, it is reasonable to consider bilateral absence of the N20 SSEP wave 24 to 72 hours after cardiac arrest or after rewarming a predictor of poor outcome (FPR, 1%; 95% CI, 0%–3%; Class IIa, LOE B-NR).	updated for 2015
2015	Prognostic Testing in Adult Patients After Cardiac Arrest: Imaging Tests	In patients who are comatose after resuscitation from cardiac arrest and not treated with TTM, it may be reasonable to use the presence of a marked reduction of the grey white ratio (GWR) on brain CT obtained within 2 hours after cardiac arrest to predict poor outcome (Class IIb, LOE B-NR).	new for 2015
2015	Prognostic Testing in Adult Patients After Cardiac Arrest: Imaging Tests	It may be reasonable to consider extensive restriction of diffusion on brain MRI at 2 to 6 days after cardiac arrest in combination with other established predictors to predict a poor neurologic outcome (Class IIb, LOE B-NR).	new for 2015
2015	Prognostic Testing in Adult Patients After Cardiac Arrest: Blood Markers	Given the possibility of high FPRs, blood levels of NSE and S-100B should not be used alone to predict a poor neurologic outcome (Class III: Harm, LOE C-LD).	updated for 2015

(*Continued*)

2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2015	Prognostic Testing in Adult Patients After Cardiac Arrest: Blood Markers	When performed with other prognostic tests at 72 hours or more after cardiac arrest, it may be reasonable to consider high serum values of NSE at 48 to 72 hours after cardiac arrest to support the prognosis of a poor neurologic outcome (Class IIb, LOE B-NR), especially if repeated sampling reveals persistently high values (Class IIb, LOE C-LD).	updated for 2015
2015	Ethics of Organ and Tissue Donation	We recommend that all patients who are resuscitated from cardiac arrest but who subsequently progress to death or brain death be evaluated for organ donation (Class I, LOE B-NR).	updated for 2015
2015	Ethics of Organ and Tissue Donation	Patients who do not have ROSC after resuscitation efforts and who would otherwise have termination of efforts may be considered candidates for kidney or liver donation in settings where programs exist (Class IIb, LOE B-NR).	new for 2015
The following recommendations were not reviewed in 2015. For more information, see the *2010 AHA Guidelines for CPR and ECC*, "Part 3: Ethics."			
2010	Principle of Futility	Conditions such as irreversible brain damage or brain death cannot be reliably assessed or predicted at the time of cardiac arrest. Withholding resuscitation and the discontinuation of life-sustaining treatment during or after resuscitation are ethically equivalent. In situations where the prognosis is uncertain, a trial of treatment may be initiated while further information is gathered to help determine the likelihood of survival, the patient's preferences, and the expected clinical course (Class IIb, LOE C).	not reviewed in 2015
2010	Terminating Resuscitative Efforts in a BLS Out-of-Hospital System	It is recommended that regional or local EMS authorities use the BLS termination rule to develop protocols for the termination of resuscitative efforts by BLS providers for adult victims of cardiac arrest in areas where advanced life support is not available or may be significantly delayed (Class I, LOE A).	not reviewed in 2015
2010	Terminating Resuscitative Efforts in a BLS Out-of-Hospital System	The reliability and validity of this rule is uncertain if modified (Class IIb, LOE A).	not reviewed in 2015
2010	Terminating Resuscitative Efforts in an ALS Out-of-Hospital System	An ALS termination of resuscitation rule was derived from a diverse population of rural and urban EMS settings. This rule recommends considering terminating resuscitation when ALL of the following criteria apply before moving to the ambulance for transport: (1) arrest was not witnessed; (2) no bystander CPR was provided; (3) no ROSC after full ALS care in the field; and (4) no AED shocks were delivered. This rule has been retrospectively externally validated for adult patients in several regions in the US, Canada, and Europe, and it is reasonable to employ this rule in all ALS services (Class IIa, LOE B).	not reviewed in 2015
2010	Terminating Resuscitative Efforts in a Combined BLS and ALS Out-of-Hospital System	In a tiered ALS- and BLS-provider system, the use of a universal rule can avoid confusion at the scene of a cardiac arrest without compromising diagnostic accuracy. The BLS rule is reasonable to use in these services (Class IIa, LOE B).	not reviewed in 2015
2010	Providing Emotional Support to the Family During Resuscitative Efforts in Cardiac Arrest	In the absence of data documenting harm and in light of data suggesting that it may be helpful, offering select family members the opportunity to be present during a resuscitation is reasonable and desirable (assuming that the patient, if an adult, has not raised a prior objection) (Class IIa, LOE C for adults and Class I, LOE B for pediatric patients).	not reviewed in 2015
2010	Providing Emotional Support to the Family During Resuscitative Efforts in Cardiac Arrest	In the absence of data documenting harm and in light of data suggesting that it may be helpful, offering select family members the opportunity to be present during a resuscitation is reasonable and desirable (assuming that the patient, if an adult, has not raised a prior objection) (Class IIa, LOE C for adults and Class I, LOE B for pediatric patients).	not reviewed in 2015
2010	Ethics of Organ and Tissue Donation	It is reasonable to suggest that all communities should optimize retrieval of tissue and organ donations in brain dead post–cardiac arrest patients (in-hospital) and those pronounced dead in the out-of-hospital setting (Class IIa, LOE B).	not reviewed in 2015
2010	Ethics of Organ and Tissue Donation	Medical directors of EMS agencies, emergency departments (EDs), and critical care units (CCUs) should develop protocols and implementation plans with the regional organ and tissue donation program to optimize donation following a cardiac arrest death (Class I, LOE C)	not reviewed in 2015
2010	Criteria for Not Starting CPR in Newly Born Infant IHCA	There are prescribed recommendations to guide the initiation of resuscitative efforts in newly born infants. When gestational age, birth weight, or congenital anomalies are associated with almost certain early death and when unacceptably high morbidity is likely among the rare survivors, resuscitation is not indicated. Examples may include extreme prematurity (gestational age <23 weeks or birth weight <400 g, anencephaly, and some major chromosomal abnormalities such as trisomy 13 (Class IIb, LOE C).	not reviewed in 2015
2010	Criteria for Not Starting CPR in Newly Born Infant IHCA	In conditions associated with uncertain prognosis where survival is borderline, the morbidity rate is relatively high, and the anticipated burden to the child is high, parental desires concerning initiation of resuscitation should be supported (Class IIb, LOE C).	not reviewed in 2015

(*Continued*)

2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
Part 4: Systems of Care and Continuous Quality Improvement			
2015	Prearrest Rapid Response Systems	For adult patients, RRT or MET systems can be effective in reducing the incidence of cardiac arrest, particularly in general care wards (Class IIa, LOE C-LD).	updated for 2015
2015	Prearrest Rapid Response Systems	Pediatric MET/RRT systems may be considered in facilities where children with high-risk illnesses are cared for on general in-patient units (Class IIb, LOE C-LD).	updated for 2015
2015	Prearrest Rapid Response Systems	The use of EWSS may be considered for adults and children (Class IIb, LOE C-LD).	updated for 2015
2015	Debriefing	It is reasonable for in-hospital systems of care to implement performance-focused debriefing of rescuers after IHCA in both adults and children (Class IIa, LOE C-LD).	updated for 2015
2015	Public-Access Defibrillation	It is recommended that PAD programs for patients with OHCA be implemented in communities at risk for cardiac arrest (Class I, LOE C-LD).	updated for 2015
2015	Dispatcher Recognition of Cardiac Arrest	It is recommended that emergency dispatchers determine if a patient is unconscious with abnormal breathing after acquiring the requisite information to determine the location of the event (Class I, LOE C-LD).	updated for 2015
2015	Dispatcher Recognition of Cardiac Arrest	If the patient is unconscious with abnormal or absent breathing, it is reasonable for the emergency dispatcher to assume that the patient is in cardiac arrest (Class IIa, LOE C-LD).	updated for 2015
2015	Dispatcher Recognition of Cardiac Arrest	Dispatchers should be educated to identify unconsciousness with abnormal and agonal gasps across a range of clinical presentations and descriptions (Class I, LOE C-LD).	updated for 2015
2015	Dispatcher Instruction in CPR	We recommend that dispatchers should provide chest compression–only CPR instructions to callers for adults with suspected OHCA (Class I, LOE C-LD).	updated for 2015
2015	Use of Social Media to Summon Rescuers	Given the low risk of harm and the potential benefit of such notifications, it may be reasonable for communities to incorporate, where available, social media technologies that summon rescuers who are willing and able to perform CPR and are in close proximity to a suspected victim of OHCA (Class IIb, LOE B-R).	updated for 2015
2015	Transport to Specialized Cardiac Arrest Centers	A regionalized approach to OHCA resuscitation that includes the use of cardiac resuscitation centers may be considered (Class IIb, LOE C-LD).	updated for 2015
2015	Immediate Recognition and Activation of the Emergency Response System	It is recommended that emergency dispatchers determine if a patient is unresponsive with abnormal breathing after acquiring the requisite information to determine the location of the event (Class I, LOE C-LD).	updated for 2015
2015	Immediate Recognition and Activation of the Emergency Response System	If the patient is unresponsive with abnormal or absent breathing, it is reasonable for the emergency dispatcher to assume that the patient is in cardiac arrest (Class IIa, LOE C-LD).	updated for 2015
2015	Immediate Recognition and Activation of the Emergency Response System	Dispatchers should be educated to identify unresponsiveness with abnormal breathing and agonal gasps across a range of clinical presentations and descriptions (Class I, LOE C-LD).	updated for 2015
2015	Early CPR	Similar to the 2010 Guidelines, it may be reasonable for rescuers to initiate CPR with chest compressions (Class IIb, LOE C-LD).	updated for 2015
2015	Untrained Lay Rescuer	Untrained lay rescuers should provide compression-only CPR, with or without dispatcher assistance (Class I, LOE C-LD).	updated for 2015
2015	Untrained Lay Rescuer	The rescuer should continue compression-only CPR until the arrival of an AED or rescuers with additional training (Class I, LOE C-LD).	updated for 2015
2015	Trained Lay Rescuer	All lay rescuers should, at a minimum, provide chest compressions for victims of cardiac arrest (Class I, LOE C-LD). In addition, if the trained lay rescuer is able to perform rescue breaths, he or she should add rescue breaths in a ratio of 30 compressions to 2 breaths.	updated for 2015
2015	Trained Lay Rescuer	The rescuer should continue CPR until an AED arrives and is ready for use or EMS providers take over care of the victim (Class I, LOE C-LD).	updated for 2015
2015	Healthcare Provider	It is reasonable for healthcare providers to provide chest compressions and ventilation for all adult patients in cardiac arrest, from either a cardiac or noncardiac cause (Class IIa, LOE C-LD).	updated for 2015
2015	Delayed Ventilation	For witnessed OHCA with a shockable rhythm, it may be reasonable for EMS systems with priority-based, multitiered response to delay positive-pressure ventilation by using a strategy of up to 3 cycles of 200 continuous compressions with passive oxygen insufflation and airway adjuncts (Class IIb, LOE C-LD).	new for 2015
2015	Recognition of Arrest	Dispatchers should instruct rescuers to provide CPR if the victim is unresponsive with no normal breathing, even when the victim demonstrates occasional gasps (Class I, LOE C-LD).	updated for 2015

(*Continued*)

2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2015	Suspected Opioid-Related Life-Threatening Emergency	For a patient with known or suspected opioid overdose who has a definite pulse but no normal breathing or only gasping (ie, a respiratory arrest), in addition to providing standard BLS care, it is reasonable for appropriately trained BLS healthcare providers to administer intramuscular or intranasal naloxone (Class IIa, LOE C-LD).	new for 2015
2015	Suspected Opioid-Related Life-Threatening Emergency	For patients in cardiac arrest, medication administration is ineffective without concomitant chest compressions for drug delivery to the tissues, so naloxone administration may be considered after initiation of CPR if there is high suspicion for opiate overdose (Class IIb, LOE C-EO).	new for 2015
2015	Suspected Opioid-Related Life-Threatening Emergency	It is reasonable to provide opioid overdose response education with or without naloxone distribution to persons at risk for opioid overdose in any setting (Class IIa, LOE C-LD).	new for 2015
2015	Hand Position During Compressions	Consistent with the 2010 Guidelines, it is reasonable to position hands for chest compressions on the lower half of the sternum in adults with cardiac arrest. (Class IIa, LOE C-LD).	updated for 2015
2015	Chest Compression Rate	In adult victims of cardiac arrest, it is reasonable for rescuers to perform chest compressions at a rate of 100/min to 120/min (Class IIa, LOE C-LD).	updated for 2015
2015	Chest Compression Depth	During manual CPR, rescuers should perform chest compressions to a depth of at least 2 inches or 5 cm for an average adult, while avoiding excessive chest compression depths (greater than 2.4 inches or 6 cm) (Class I, LOE C-LD).	updated for 2015
2015	Chest Wall Recoil	It is reasonable for rescuers to avoid leaning on the chest between compressions to allow full chest wall recoil for adults in cardiac arrest (Class IIa, LOE C-LD).	updated for 2015
2015	Minimizing Interruptions in Chest Compressions	In adult cardiac arrest, total preshock and postshock pauses in chest compressions should be as short as possible (Class I, LOE C-LD).	updated for 2015
2015	Minimizing Interruptions in Chest Compressions	For adults in cardiac arrest receiving CPR without an advanced airway, it is reasonable to pause compressions for less than 10 seconds to deliver 2 breaths (Class IIa, LOE C-LD).	updated for 2015
2015	Minimizing Interruptions in Chest Compressions	In adult cardiac arrest with an unprotected airway, it may be reasonable to perform CPR with the goal of a chest compression fraction as high as possible, with a target of at least 60% (Class IIb, LOE C-LD).	new for 2015
2015	Compression-to-Ventilation Ratio	Consistent with the 2010 Guidelines, it is reasonable for rescuers to provide a compression-to-ventilation ratio of 30:2 for adults in cardiac arrest (Class IIa, LOE C-LD).	updated for 2015
2015	Layperson—Compression-Only CPR Versus Conventional CPR	Dispatchers should instruct untrained lay rescuers to provide compression-only CPR for adults with sudden cardiac arrest (Class I, LOE B-R).	updated for 2015
2015	Layperson—Compression-Only CPR Versus Conventional CPR	Compression-only CPR is a reasonable alternative to conventional CPR in the adult cardiac arrest patient (Class IIa, LOE C-LD).	updated for 2015
2015	Layperson—Compression-Only CPR Versus Conventional CPR	For trained rescuers, ventilation may be considered in addition to chest compressions for the adult in cardiac arrest (Class IIb, LOE C-LD).	updated for 2015
2015	Open the Airway: Lay Rescuer	For victims with suspected spinal injury, rescuers should initially use manual spinal motion restriction (eg, placing 1 hand on either side of the patient's head to hold it still) rather than immobilization devices, because use of immobilization devices by lay rescuers may be harmful (Class III: Harm, LOE C-LD).	updated for 2015
2015	Bag-Mask Ventilation	As long as the patient does not have an advanced airway in place, the rescuers should deliver cycles of 30 compressions and 2 breaths during CPR. The rescuer delivers breaths during pauses in compressions and delivers each breath over approximately 1 second (Class IIa, LOE C-LD).	updated for 2015
2015	Ventilation With an Advanced Airway	When the victim has an advanced airway in place during CPR, rescuers no longer deliver cycles of 30 compressions and 2 breaths (ie, they no longer interrupt compressions to deliver 2 breaths). Instead, it may be reasonable for the provider to deliver 1 breath every 6 seconds (10 breaths per minute) while continuous chest compressions are being performed (Class IIb, LOE C-LD).	updated for 2015
2015	Passive Oxygen Versus Positive-Pressure Oxygen During CPR	We do not recommend the routine use of passive ventilation techniques during conventional CPR for adults, because the usefulness/effectiveness of these techniques is unknown (Class IIb, LOE C-EO).	new for 2015
2015	Passive Oxygen Versus Positive-Pressure Oxygen During CPR	However, in EMS systems that use bundles of care involving continuous chest compressions, the use of passive ventilation techniques may be considered as part of that bundle (Class IIb, LOE C-LD).	new for 2015
2015	CPR Before Defibrillation	For witnessed adult cardiac arrest when an AED is immediately available, it is reasonable that the defibrillator be used as soon as possible (Class IIa, LOE C-LD).	updated for 2015

(*Continued*)

2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2015	CPR Before Defibrillation	For adults with unmonitored cardiac arrest or for whom an AED is not immediately available, it is reasonable that CPR be initiated while the defibrillator equipment is being retrieved and applied and that defibrillation, if indicated, be attempted as soon as the device is ready for use (Class IIa, LOE B-R).	updated for 2015
2015	Analysis of Rhythm During Compressions	There is insufficient evidence to recommend the use of artifact-filtering algorithms for analysis of ECG rhythm during CPR. Their use may be considered as part of a research program or if an EMS system has already incorporated ECG artifact-filtering algorithms in its resuscitation protocols (Class IIb, LOE C-EO).	new for 2015
2015	Timing of Rhythm Check	It may be reasonable to immediately resume chest compressions after shock delivery for adults in cardiac arrest in any setting (Class IIb, LOE C-LD).	updated for 2015
2015	Chest Compression Feedback	It may be reasonable to use audiovisual feedback devices during CPR for real-time optimization of CPR performance (Class IIb, LOE B-R).	updated for 2015
The following recommendations were not reviewed in 2015. For more information, *see the 2010 AHA Guidelines for CPR and ECC*, "Part 5: Adult Basic Life Support" and "Part 6: Electrical Therapies: Automated External Defibrillators, Defibrillation, Cardioversion, and Pacing."			
2010	Activating the Emergency Response System	The EMS system quality improvement process, including review of the quality of dispatcher CPR instructions provided to specific callers, is considered an important component of a high-quality lifesaving program (Class IIa, LOE B).	not reviewed in 2015
2010	Pulse Check	The healthcare provider should take no more than 10 seconds to check for a pulse and, if the rescuer does not definitely feel a pulse within that time period, the rescuer should start chest compressions (Class IIa, LOE C).	not reviewed in 2015
2010	Chest Compressions	Effective chest compressions are essential for providing blood flow during CPR. For this reason all patients in cardiac arrest should receive chest compressions (Class I, LOE B).	not reviewed in 2015
2010	Rescue Breaths	Deliver each rescue breath over 1 second (Class IIa, LOE C).	not reviewed in 2015
2010	Rescue Breaths	Give a sufficient tidal volume to produce visible chest rise (Class IIa, LOE C).	not reviewed in 2015
2010	Early Defibrillation With an AED	When 2 or more rescuers are present, one rescuer should begin chest compressions while a second rescuer activates the emergency response system and gets the AED (or a manual defibrillator in most hospitals) (Class IIa, LOE C).	not reviewed in 2015
2010	Recognition of Arrest	The rescuer should treat the victim who has occasional gasps as if he or she is not breathing (Class I, LOE C).	not reviewed in 2015
2010	Technique: Chest Compressions	The rescuer should place the heel of one hand on the center (middle) of the victim's chest (which is the lower half of the sternum) and the heel of the other hand on top of the first so that the hands are overlapped and parallel (Class IIa, LOE B).	not reviewed in 2015
2010	Technique: Chest Compressions	Because of the difficulty in providing effective chest compressions while moving the patient during CPR, the resuscitation should generally be conducted where the patient is found (Class IIa, LOE C).	not reviewed in 2015
2010	Compression-Ventilation Ratio	Once an advanced airway is in place, 2 rescuers no longer need to pause chest compressions for ventilations. Instead, the compressing rescuer should give continuous chest compressions at a rate of at least 100 per minute without pauses for ventilation (Class IIa, LOE B).	not reviewed in 2015
2010	Open the Airway: Lay Rescuer	The trained lay rescuer who feels confident that he or she can perform both compressions and ventilations should open the airway using a head tilt–chin lift maneuver (Class IIa, LOE B).	not reviewed in 2015
2010	Open the Airway: Healthcare Provider	Although the head tilt–chin lift technique was developed using unconscious, paralyzed adult volunteers and has not been studied in victims with cardiac arrest, clinical and radiographic evidence and a case series have shown it to be effective (Class IIa, LOE B).	not reviewed in 2015
2010	Open the Airway: Healthcare Provider	If healthcare providers suspect a cervical spine injury, they should open the airway using a jaw thrust without head extension (Class IIb, LOE C).	not reviewed in 2015
2010	Open the Airway: Healthcare Provider	Because maintaining a patent airway and providing adequate ventilation are priorities in CPR (Class I, LOE C), use the head tilt–chin lift maneuver if the jaw thrust does not adequately open the airway.	not reviewed in 2015
2010	Rescue Breathing	Deliver each rescue breath over 1 second (Class IIa, LOE C).	not reviewed in 2015
2010	Rescue Breathing	Give a sufficient tidal volume to produce visible chest rise (Class IIa, LOE C).	not reviewed in 2015
2010	Rescue Breathing	During adult CPR, tidal volumes of approximately 500 to 600 mL (6 to 7 mL/kg) should suffice (Class IIa, LOE B).	not reviewed in 2015
2010	Rescue Breathing	Rescuers should avoid excessive ventilation (too many breaths or too large a volume) during CPR (Class III, LOE B).	not reviewed in 2015
2010	Mouth-to-Mouth Rescue Breathing	Give 1 breath over 1 second, take a "regular" (not a deep) breath, and give a second rescue breath over 1 second (Class IIb, LOE C).	not reviewed in 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2010	Mouth-to-Mouth Rescue Breathing	If an adult victim with spontaneous circulation (ie, strong and easily palpable pulses) requires support of ventilation, the healthcare provider should give rescue breaths at a rate of about 1 breath every 5 to 6 seconds, or about 10 to 12 breaths per minute (Class IIb, LOE C).	not reviewed in 2015
2010	Mouth-to-Nose and Mouth-to-Stoma Ventilation	Mouth-to-nose ventilation is recommended if ventilation through the victim's mouth is impossible (eg, the mouth is seriously injured), the mouth cannot be opened, the victim is in water, or a mouth-to-mouth seal is difficult to achieve (Class IIa, LOE C).	not reviewed in 2015
2010	Mouth-to-Nose and Mouth-to-Stoma Ventilation	A reasonable alternative is to create a tight seal over the stoma with a round, pediatric face mask (Class IIb, LOE C).	not reviewed in 2015
2010	Bag-Mask Ventilation	The rescuer should use an adult (1 to 2 L) bag to deliver approximately 600 mL tidal volume for adult victims. This amount is usually sufficient to produce visible chest rise and maintain oxygenation and normocarbia in apneic patients (Class IIa, LOE C).	not reviewed in 2015
2010	Bag-Mask Ventilation	The rescuer delivers ventilations during pauses in compressions and delivers each breath over 1 second (Class IIa, LOE C).	not reviewed in 2015
2010	Mouth-to-Nose and Mouth-to-Stoma Ventilation	Ventilation with a bag through these devices provides an acceptable alternative to bag-mask ventilation for well-trained healthcare providers who have sufficient experience to use the devices for airway management during cardiac arrest (Class IIa, LOE B).	not reviewed in 2015
2010	Cricoid Pressure	The routine use of cricoid pressure in adult cardiac arrest is not recommended (Class III, LOE B).	not reviewed in 2015
2010	AED Defibrillation	Rapid defibrillation is the treatment of choice for VF of short duration, such as for victims of witnessed out-of-hospital cardiac arrest or for hospitalized patients whose heart rhythm is monitored (Class I, LOE A).	not reviewed in 2015
2010	AED Defibrillation	There is insufficient evidence to recommend for or against delaying defibrillation to provide a period of CPR for patients in VF/pulseless VT out-of-hospital cardiac arrest. In settings with lay rescuer AED programs (AED onsite and available) and for in-hospital environments, or if the EMS rescuer witnesses the collapse, the rescuer should use the defibrillator as soon as it is available (Class IIa, LOE C).	not reviewed in 2015
2010	Recovery Position	The position should be stable, near a true lateral position, with the head dependent and with no pressure on the chest to impair breathing (Class IIa, LOE C).	not reviewed in 2015
2010	Acute Coronary Syndromes	If the patient has not taken aspirin and has no history of aspirin allergy and no evidence of recent gastrointestinal bleeding, EMS providers should give the patient nonenteric aspirin (160 to 325 mg) to chew (Class I, LOE C).	not reviewed in 2015
2010	Acute Coronary Syndromes	Although it is reasonable to consider the early administration of nitroglycerin in select hemodynamically stable patients, insufficient evidence exists to support or refute the routine administration of nitroglycerin in the ED or prehospital setting in patients with a suspected ACS (Class IIb, LOE B).	not reviewed in 2015
2010	Stroke	Patients at high risk for stroke, their family members, and BLS providers should learn to recognize the signs and symptoms of stroke and to call EMS as soon as any signs of stroke are present (Class I, LOE C).	not reviewed in 2015
2010	Stroke	EMS dispatchers should be trained to suspect stroke and rapidly dispatch emergency responders. EMS personnel should be able to perform an out-of-hospital stroke assessment (Class I, LOE B), establish the time of symptom onset when possible, provide cardiopulmonary support, and notify the receiving hospital that a patient with possible stroke is being transported.	not reviewed in 2015
2010	Stroke	EMS systems should have protocols that address triaging the patient when possible directly to a stroke center (Class I, LOE B).	not reviewed in 2015
2010	Stroke	Both out-of-hospital and in-hospital medical personnel should administer supplementary oxygen to hypoxemic (ie, oxygen saturation <94%) stroke patients (Class I, LOE C) or those with unknown oxygen saturation.	not reviewed in 2015
2010	Stroke	Unless the patient is hypotensive (systolic blood pressure <90 mm Hg), prehospital intervention for blood pressure is not recommended (Class III, LOE C).	not reviewed in 2015
2010	Drowning	Mouth-to-mouth ventilation in the water may be helpful when administered by a trained rescuer (Class IIb, LOE C).	not reviewed in 2015
Part 6: Alternative Techniques and Ancillary Devices for Cardiopulmonary Resuscitation			
2015	Devices to Support Circulation: Impedance Threshold Device	The routine use of the ITD as an adjunct during conventional CPR is not recommended (Class III: No Benefit, LOE A).	new for 2015
2015	Devices to Support Circulation: Active Compression-Decompression CPR and Impedance Threshold Device	The existing evidence, primarily from 1 large RCT of low quality, does not support the routine use of ACD-CPR+ITD as an alternative to conventional CPR. The combination may be a reasonable alternative in settings with available equipment and properly trained personnel (Class IIb, LOE C-LD).	new for 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2015	Devices to Support Circulation: Mechanical Chest Compression Devices: Piston Device	The evidence does not demonstrate a benefit with the use of mechanical piston devices for chest compressions versus manual chest compressions in patients with cardiac arrest. Manual chest compressions remain the standard of care for the treatment of cardiac arrest, but mechanical chest compressions using a piston device may be a reasonable alternative for use by properly trained personnel (Class IIb, LOE B-R).	new for 2015
2015	Devices to Support Circulation: Mechanical Chest Compression Devices: Piston Device	The use of piston devices for CPR may be considered in specific settings where the delivery of high-quality manual compressions may be challenging or dangerous for the provider (eg, prolonged CPR during hypothermic cardiac arrest, CPR in a moving ambulance, CPR in the angiography suite, CPR during preparation for extracorporeal CPR [ECPR]), provided that rescuers strictly limit interruptions in CPR during deployment and removal of the device (Class IIb, LOE C-EO).	new for 2015
2015	Devices to Support Circulation: Load-Distributing Band Devices	The evidence does not demonstrate a benefit with the use of LDB-CPR for chest compressions versus manual chest compressions in patients with cardiac arrest. Manual chest compressions remain the standard of care for the treatment of cardiac arrest, but LDB-CPR may be a reasonable alternative for use by properly trained personnel (Class IIb, LOE B-R).	new for 2015
2015	Devices to Support Circulation: Load-Distributing Band Devices	The use of LDB-CPR may be considered in specific settings where the delivery of high-quality manual compressions may be challenging or dangerous for the provider (eg, prolonged CPR during hypothermic cardiac arrest, CPR in a moving ambulance, CPR in the angiography suite, CPR during preparation for ECPR), provided that rescuers strictly limit interruptions in CPR during deployment and removal of the devices (Class IIb, LOE E).	new for 2015
2015	Extracorporeal Techniques and Invasive Perfusion Devices: Extracorporeal CPR	There is insufficient evidence to recommend the routine use of ECPR for patients with cardiac arrest. It may be considered for select patients for whom the suspected etiology of the cardiac arrest is potentially reversible during a limited period of mechanical cardiorespiratory support (Class IIb, LOE C-LD).	new for 2015
The following recommendations were not reviewed in 2015. For more information, see the *2010 AHA Guidelines for CPR and ECC*, "Part 7: CPR Techniques and Devices."			
2010	Open-Chest CPR	Open-chest CPR can be useful if cardiac arrest develops during surgery when the chest or abdomen is already open, or in the early postoperative period after cardiothoracic surgery (Class IIa, LOE C).	not reviewed in 2015
2010	Open-Chest CPR	A resuscitative thoracotomy to facilitate open-chest CPR may be considered in very select circumstances of adults and children with out-of-hospital cardiac arrest from penetrating trauma with short transport times to a trauma facility (Class IIb, LOE C).	not reviewed in 2015
2010	Interposed Abdominal Compression CPR	IAC-CPR may be considered during in-hospital resuscitation when sufficient personnel trained in its use are available (Class IIb, LOE B).	not reviewed in 2015
2010	"Cough" CPR	"Cough" CPR may be considered in settings such as the cardiac catheterization laboratory for conscious, supine, and monitored patients if the patient can be instructed and coached to cough forcefully every 1 to 3 seconds during the initial seconds of an arrhythmic cardiac arrest. It should not delay definitive treatment (Class IIb, LOE C).	not reviewed in 2015
2010	Prone CPR	When the patient cannot be placed in the supine position, it may be reasonable for rescuers to provide CPR with the patient in the prone position, particularly in hospitalized patients with an advanced airway in place (Class IIb, LOE C).	not reviewed in 2015
2010	Precordial Thump	The precordial thump should not be used for unwitnessed out-of-hospital cardiac arrest (Class III, LOE C).	not reviewed in 2015
2010	Precordial Thump	The precordial thump may be considered for patients with witnessed, monitored, unstable ventricular tachycardia including pulseless VT if a defibrillator is not immediately ready for use (Class IIb, LOE C), but it should not delay CPR and shock delivery.	not reviewed in 2015
2010	Automatic Transport Ventilators	During prolonged resuscitation efforts, the use of an ATV (pneumatically powered and time- or pressure-cycled) may provide ventilation and oxygenation similar to that possible with the use of a manual resuscitation bag, while allowing the Emergency Medical Services (EMS) team to perform other tasks (Class IIb, LOE C).	not reviewed in 2015
2010	Manually Triggered, Oxygen-Powered, Flow-Limited Resuscitators	Manually triggered, oxygen-powered, flow-limited resuscitators may be considered for the management of patients who do not have an advanced airway in place and for whom a mask is being used for ventilation during CPR (Class IIb, LOE C).	not reviewed in 2015
2010	Manually Triggered, Oxygen-Powered, Flow-Limited Resuscitators	Rescuers should avoid using the automatic mode of the oxygen-powered, flow-limited resuscitator during CPR because it may generate high positive end-expiratory pressure (PEEP) that may impede venous return during chest compressions and compromise forward blood flow (Class III, LOE C).	not reviewed in 2015
2010	Active Compression-Decompression CPR	There is insufficient evidence to recommend for or against the routine use of ACD-CPR. ACD-CPR may be considered for use when providers are adequately trained and monitored (Class IIb, LOE B).	not reviewed in 2015
Part 8: Adult Advanced Cardiovascular Life Support			
2015	Adjuncts to CPR	When supplementary oxygen is available, it may be reasonable to use the maximal feasible inspired oxygen concentration during CPR (Class IIb, LOE C-EO).	updated for 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2015	Adjuncts to CPR	Although no clinical study has examined whether titrating resuscitative efforts to physiologic parameters during CPR improves outcome, it may be reasonable to use physiologic parameters (quantitative waveform capnography, arterial relaxation diastolic pressure, arterial pressure monitoring, and central venous oxygen saturation) when feasible to monitor and optimize CPR quality, guide vasopressor therapy, and detect ROSC (Class IIb, LOE C-EO).	updated for 2015
2015	Adjuncts to CPR	Ultrasound (cardiac or noncardiac) may be considered during the management of cardiac arrest, although its usefulness has not been well established (Class IIb, LOE C-EO).	updated for 2015
2015	Adjuncts to CPR	If a qualified sonographer is present and use of ultrasound does not interfere with the standard cardiac arrest treatment protocol, then ultrasound may be considered as an adjunct to standard patient evaluation (Class IIb, LOE C-EO).	updated for 2015
2015	Adjuncts for Airway Control and Ventilation	Either a bag-mask device or an advanced airway may be used for oxygenation and ventilation during CPR in both the in-hospital and out-of-hospital setting (Class IIb, LOE C-LD).	updated for 2015
2015	Adjuncts for Airway Control and Ventilation	For healthcare providers trained in their use, either an SGA device or an ETT may be used as the initial advanced airway during CPR (Class IIb, LOE C-LD).	updated for 2015
2015	Adjuncts for Airway Control and Ventilation	Continuous waveform capnography is recommended in addition to clinical assessment as the most reliable method of confirming and monitoring correct placement of an ETT (Class I, LOE C-LD).	updated for 2015
2015	Adjuncts for Airway Control and Ventilation	If continuous waveform capnometry is not available, a nonwaveform CO_2 detector, esophageal detector device, or ultrasound used by an experienced operator is a reasonable alternative (Class IIa, LOE B-NR).	updated for 2015
2015	Adjuncts for Airway Control and Ventilation	After placement of an advanced airway, it may be reasonable for the provider to deliver 1 breath every 6 seconds (10 breaths/min) while continuous chest compressions are being performed (Class IIb, LOE C-LD).	updated for 2015
2015	Management of Cardiac Arrest	Defibrillators (using BTE, RLB, or monophasic waveforms) are recommended to treat atrial and ventricular arrhythmias (Class I, LOE B-NR).	updated for 2015
2015	Management of Cardiac Arrest	Based on their greater success in arrhythmia termination, defibrillators using biphasic waveforms (BTE or RLB) are preferred to monophasic defibrillators for treatment of both atrial and ventricular arrhythmias (Class IIa, LOE B-R).	updated for 2015
2015	Management of Cardiac Arrest	In the absence of conclusive evidence that 1 biphasic waveform is superior to another in termination of VF, it is reasonable to use the manufacturer's recommended energy dose for the first shock. If this is not known, defibrillation at the maximal dose may be considered (Class IIb, LOE C-LD).	updated for 2015
2015	Management of Cardiac Arrest	It is reasonable that selection of fixed versus escalating energy for subsequent shocks be based on the specific manufacturer's instructions (Class IIa, LOE C-LD).	updated for 2015
2015	Management of Cardiac Arrest	If using a manual defibrillator capable of escalating energies, higher energy for second and subsequent shocks may be considered (Class IIb, LOE C-LD).	updated for 2015
2015	Management of Cardiac Arrest	A single-shock strategy (as opposed to stacked shocks) is reasonable for defibrillation (Class IIa, LOE B-NR).	updated for 2015
2015	Management of Cardiac Arrest	Amiodarone may be considered for VF/pVT that is unresponsive to CPR, defibrillation, and a vasopressor therapy (Class IIb, LOE B-R).	updated for 2015
2015	Management of Cardiac Arrest	Lidocaine may be considered as an alternative to amiodarone for VF/pVT that is unresponsive to CPR, defibrillation, and vasopressor therapy (Class IIb, LOE C-LD).	updated for 2015
2015	Management of Cardiac Arrest	The routine use of magnesium for VF/pVT is not recommended in adult patients (Class III: No Benefit, LOE B-R).	updated for 2015
2015	Management of Cardiac Arrest	There is inadequate evidence to support the routine use of lidocaine after cardiac arrest. However, the initiation or continuation of lidocaine may be considered immediately after ROSC from cardiac arrest due to VF/pVT (Class IIb, LOE C-LD).	new for 2015
2015	Management of Cardiac Arrest	There is inadequate evidence to support the routine use of a β-blocker after cardiac arrest. However, the initiation or continuation of an oral or intravenous β-blocker may be considered early after hospitalization from cardiac arrest due to VF/pVT (Class IIb, LOE C-LD).	new for 2015
2015	Management of Cardiac Arrest	Standard-dose epinephrine (1 mg every 3 to 5 minutes) may be reasonable for patients in cardiac arrest (Class IIb, LOE B-R).	updated for 2015
2015	Management of Cardiac Arrest	High-dose epinephrine is not recommended for routine use in cardiac arrest (Class III: No Benefit, LOE B-R).	new for 2015
2015	Management of Cardiac Arrest	Vasopressin offers no advantage as a substitute for epinephrine in cardiac arrest (Class IIb, LOE B-R).	updated for 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2015	Management of Cardiac Arrest	Vasopressin in combination with epinephrine offers no advantage as a substitute for standard-dose epinephrine in cardiac arrest (Class IIb, LOE B-R).	new for 2015
2015	Management of Cardiac Arrest	It may be reasonable to administer epinephrine as soon as feasible after the onset of cardiac arrest due to an initial nonshockable rhythm (Class IIb, LOE C-LD).	updated for 2015
2015	Management of Cardiac Arrest	In IHCA, the combination of intra-arrest vasopressin, epinephrine, and methylprednisolone and post-arrest hydrocortisone as described by Mentzelopoulos et al may be considered; however, further studies are needed before recommending the routine use of this therapeutic strategy (Class IIb, LOE C-LD).	new for 2015
2015	Management of Cardiac Arrest	For patients with OHCA, use of steroids during CPR is of uncertain benefit (Class IIb, LOE C-LD).	new for 2015
2015	Management of Cardiac Arrest	In intubated patients, failure to achieve an $ETCO_2$ of greater than 10 mm Hg by waveform capnography after 20 minutes of CPR may be considered as one component of a multimodal approach to decide when to end resuscitative efforts but should not be used in isolation (Class IIb, LOE C-LD).	new for 2015
2015	Management of Cardiac Arrest	In nonintubated patients, a specific $ETCO_2$ cutoff value at any time during CPR should not be used as an indication to end resuscitative efforts (Class III: Harm, LOE C-EO).	new for 2015
2015	Management of Cardiac Arrest	There is insufficient evidence to recommend the routine use of ECPR for patients with cardiac arrest. In settings where it can be rapidly implemented, ECPR may be considered for select cardiac arrest patients for whom the suspected etiology of the cardiac arrest is potentially reversible during a limited period of mechanical cardiorespiratory support. (Class IIb, LOE C-LD).	new for 2015
The following recommendations were not reviewed in 2015. For more information, see the *2010 AHA Guidelines for CPR and ECC*, "Part 8: Adult Advanced Cardiovascular Life Support" and "Part 6: Electrical Therapies: Automated External Defibrillators, Defibrillation, Cardioversion, and Pacing."			
2010	Cricoid Pressure	The routine use of cricoid pressure in cardiac arrest is not recommended (Class III, LOE C).	not reviewed in 2015
2010	Oropharyngeal Airways	To facilitate delivery of ventilations with a bag-mask device, oropharyngeal airways can be used in unconscious (unresponsive) patients with no cough or gag reflex and should be inserted only by persons trained in their use (Class IIa, LOE C).	not reviewed in 2015
2010	Nasopharyngeal Airways	In the presence of known or suspected basal skull fracture or severe coagulopathy, an oral airway is preferred (Class IIa, LOE C).	not reviewed in 2015
2010	Postintubation Airway Management	The endotracheal tube should be secured with tape or a commercial device (Class I, LOE C).	not reviewed in 2015
2010	Postintubation Airway Management	One out-of-hospital study and 2 studies in an intensive care setting indicate that backboards, commercial devices for securing the endotracheal tube, and other strategies provide equivalent methods for preventing inadvertent tube displacement when compared with traditional methods of securing the tube (tape). These devices may be considered during patient transport (Class IIb, LOE C).	not reviewed in 2015
2010	Automatic Transport Ventilators	In both out-of-hospital and in-hospital settings, automatic transport ventilators (ATVs) can be useful for ventilation of adult patients in noncardiac arrest who have an advanced airway in place (Class IIb, LOE C).	not reviewed in 2015
2010	Automatic Transport Ventilators	During prolonged resuscitative efforts the use of an ATV (pneumatically powered and time- or pressure-cycled) may allow the EMS team to perform other tasks while providing adequate ventilation and oxygenation (Class IIb, LOE C).	not reviewed in 2015
2010	Automatic Versus Manual Modes for Multimodal Defibrillators	Current evidence indicates that the benefit of using a multimodal defibrillator in manual instead of automatic mode during cardiac arrest is uncertain (Class IIb, LOE C).	not reviewed in 2015
2010	CPR Before Defibrillation	Performing CPR while a defibrillator is readied for use is strongly recommended for all patients in cardiac arrest (Class I, LOE B)	not reviewed in 2015
2010	CPR Before Defibrillation	At this time the benefit of delaying defibrillation to perform CPR before defibrillation is unclear (Class IIb, LOE B).	not reviewed in 2015
2010	Drug Therapy for PEA/ Asystole	Available evidence suggests that the routine use of atropine during PEA or asystole is unlikely to have a therapeutic benefit (Class IIb, LOE B).	not reviewed in 2015
2010	Coronary Perfusion Pressure and Arterial Relaxation Pressure	It is reasonable to consider using arterial relaxation "diastolic" pressure to monitor CPR quality, optimize chest compressions, and guide vasopressor therapy. (Class IIb, LOE C).	not reviewed in 2015
2010	Coronary Perfusion Pressure and Arterial Relaxation Pressure	If the arterial relaxation "diastolic" pressure is <20 mm Hg, it is reasonable to consider trying to improve quality of CPR by optimizing chest compression parameters or giving a vasopressor or both (Class IIb, LOE C).	not reviewed in 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2010	Coronary Perfusion Pressure and Arterial Relaxation Pressure	Arterial pressure monitoring can also be used to detect ROSC during chest compressions or when a rhythm check reveals an organized rhythm (Class IIb, LOE C).	not reviewed in 2015
2010	Central Venous Oxygen Saturation	Therefore, when in place before cardiac arrest, it is reasonable to consider using continuous $Scvo_2$ measurement to monitor quality of CPR, optimize chest compressions, and detect ROSC during chest compressions or when rhythm check reveals an organized rhythm (Class IIb, LOE C).	not reviewed in 2015
2010	Central Venous Oxygen Saturation	If $Scvo_2$ is <30%, it is reasonable to consider trying to improve the quality of CPR by optimizing chest compression parameters (Class IIb, LOE C).	not reviewed in 2015
2010	Arterial Blood Gases	Routine measurement of arterial blood gases during CPR has uncertain value (Class IIb, LOE C).	not reviewed in 2015
2010	IO Drug Delivery	It is reasonable for providers to establish IO access if IV access is not readily available (Class IIa, LOE C).	not reviewed in 2015
2010	Central IV Drug Delivery	The appropriately trained provider may consider placement of a central line (internal jugular or subclavian) during cardiac arrest, unless there are contraindications (Class IIb, LOE C).	not reviewed in 2015
2010	Endotracheal Drug Delivery	If IV or IO access cannot be established, epinephrine, vasopressin, and lidocaine may be administered by the endotracheal route during cardiac arrest (Class IIb, LOE B).	not reviewed in 2015
2010	Atropine	Available evidence suggests that routine use of atropine during PEA or asystole is unlikely to have a therapeutic benefit (Class IIb, LOE B).	not reviewed in 2015
2010	Sodium Bicarbonate	Routine use of sodium bicarbonate is not recommended for patients in cardiac arrest (Class III, LOE B).	not reviewed in 2015
2010	Calcium	Routine administration of calcium for treatment of in-hospital and out-of-hospital cardiac arrest is not recommended (Class III, LOE B).	not reviewed in 2015
2010	Precordial Thump	The precordial thump may be considered for termination of witnessed monitored unstable ventricular tachyarrhythmias when a defibrillator is not immediately ready for use (Class IIb, LOE B), but should not delay CPR and shock delivery.	not reviewed in 2015
2010	Management of Symptomatic Bradycardia and Tachycardia	If bradycardia produces signs and symptoms of instability (eg, acutely altered mental status, ischemic chest discomfort, acute heart failure, hypotension, or other signs of shock that persist despite adequate airway and breathing), the initial treatment is atropine (Class IIa, LOE B).	not reviewed in 2015
2010	Management of Symptomatic Bradycardia and Tachycardia	If bradycardia is unresponsive to atropine, intravenous (IV) infusion of β-adrenergic agonists with rate-accelerating effects (dopamine, epinephrine) or transcutaneous pacing (TCP) can be effective (Class IIa, LOE B) while the patient is prepared for emergent transvenous temporary pacing if required.	not reviewed in 2015
2010	Management of Symptomatic Bradycardia and Tachycardia	If the tachycardic patient is unstable with severe signs and symptoms related to a suspected arrhythmia (eg, acute altered mental status, ischemic chest discomfort, acute heart failure, hypotension, or other signs of shock), immediate cardioversion should be performed (with prior sedation in the conscious patient) (Class I, LOE B).	not reviewed in 2015
2010	Management of Symptomatic Bradycardia and Tachycardia	In select cases of regular narrow-complex tachycardia with unstable signs or symptoms, a trial of adenosine before cardioversion is reasonable to consider (Class IIb, LOE C).	not reviewed in 2015
2010	Atropine	Atropine remains the first-line drug for acute symptomatic bradycardia (Class IIa, LOE B).	not reviewed in 2015
2010	Pacing	It is reasonable for healthcare providers to initiate TCP in unstable patients who do not respond to atropine (Class IIa, LOE B).	not reviewed in 2015
2010	Pacing	Immediate pacing might be considered in unstable patients with high-degree AV block when IV access is not available (Class IIb, LOE C).	not reviewed in 2015
2010	Pacing	If the patient does not respond to drugs or TCP, transvenous pacing is probably indicated (Class IIa, LOE C)	not reviewed in 2015
2010	Dopamine	Dopamine infusion may be used for patients with symptomatic bradycardia, particularly if associated with hypotension, in whom atropine may be inappropriate or after atropine fails (Class IIb, LOE B).	not reviewed in 2015
2010	Wide-Complex Tachycardia - Evaluation	Precordial thump may be considered for patients with witnessed, monitored, unstable ventricular tachycardia if a defibrillator is not immediately ready for use (Class IIb, LOE C).	not reviewed in 2015
2010	Therapy for Regular Wide-Complex Tachycardias	If the etiology of the rhythm cannot be determined, the rate is regular, and the QRS is monomorphic, recent evidence suggests that IV adenosine is relatively safe for both treatment and diagnosis (Class IIb, LOE B).	not reviewed in 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2010	Therapy for Regular Wide-Complex Tachycardias	Adenosine should not be given for unstable or for irregular or polymorphic wide-complex tachycardias, as it may cause degeneration of the arrhythmia to VF (Class III, LOE C).	not reviewed in 2015
2010	Therapy for Regular Wide-Complex Tachycardias	Verapamil is contraindicated for wide-complex tachycardias unless known to be of supraventricular origin (Class III, LOE B).	not reviewed in 2015
2010	Therapy for Regular Wide-Complex Tachycardias	If IV antiarrhythmics are administered, procainamide (Class IIa, LOE B), amiodarone (Class IIb, LOE B), or sotalol (Class IIb, LOE B) can be considered.	not reviewed in 2015
2010	Therapy for Regular Wide-Complex Tachycardias	Procainamide and sotalol should be avoided in patients with prolonged QT. If one of these antiarrhythmic agents is given, a second agent should not be given without expert consultation (Class III, LOE B).	not reviewed in 2015
2010	Therapy for Regular Wide-Complex Tachycardias	If antiarrhythmic therapy is unsuccessful, cardioversion or expert consultation should be considered (Class IIa, LOE C).	not reviewed in 2015
2010	Rate Control	IV β-blockers and nondihydropyridine calcium channel blockers such as diltiazem are the drugs of choice for acute rate control in most individuals with atrial fibrillation and rapid ventricular response (Class IIa, LOE A).	not reviewed in 2015
2010	Polymorphic (Irregular) VT	Magnesium is unlikely to be effective in preventing polymorphic VT in patients with a normal QT interval (Class IIb, LOE C), but amiodarone may be effective (Class IIb, LOE C).	not reviewed in 2015
2010	Polymorphic (Irregular) VT	In the absence of a prolonged QT interval, the most common cause of polymorphic VT is myocardial ischemia. In this situation IV amiodarone and β-blockers may reduce the frequency of arrhythmia recurrence (Class IIb, LOE C).	not reviewed in 2015
2010	Ventilation and Oxygen Administration During CPR	Advanced airway placement in cardiac arrest should not delay initial CPR and defibrillation for VF cardiac arrest (Class I, LOE C).	not reviewed in 2015
2010	Advanced Airways	If advanced airway placement will interrupt chest compressions, providers may consider deferring insertion of the airway until the patient fails to respond to initial CPR and defibrillation attempts or demonstrates ROSC (Class IIb, LOE C).	not reviewed in 2015
2010	Endotracheal Intubation	EMS systems that perform prehospital intubation should provide a program of ongoing quality improvement to minimize complications (Class IIa, LOE B).	not reviewed in 2015
2010	VF Waveform Analysis to Predict Defibrillation Success	The value of VF waveform analysis to guide management of defibrillation in adults with in-hospital and out-of-hospital cardiac arrest is uncertain (Class IIb, LOE C).	not reviewed in 2015
2010	Fibrinolysis	Fibrinolytic therapy should not be routinely used in cardiac arrest (Class III, LOE B).	not reviewed in 2015
2010	Pacing	Electric pacing is not recommended for routine use in cardiac arrest (Class III, LOE B).	not reviewed in 2015
2010	Epinephrine	Epinephrine infusion may be used for patients with symptomatic bradycardia, particularly if associated with hypotension, for whom atropine may be inappropriate or after atropine fails (Class IIb, LOE B).	not reviewed in 2015
2010	Initial Evaluation and Treatment of Tachyarrhythmias	If not hypotensive, the patient with a regular narrow-complex SVT (likely due to suspected reentry, paroxysmal supraventricular tachycardia, as described below) may be treated with adenosine while preparations are made for synchronized cardioversion (Class IIb, LOE C).	not reviewed in 2015
2010	Therapy	If PSVT does not respond to vagal maneuvers, give 6 mg of IV adenosine as a rapid IV push through a large (eg, antecubital) vein followed by a 20 mL saline flush (Class I, LOE B).	not reviewed in 2015
2010	Therapy	If adenosine or vagal maneuvers fail to convert PSVT, PSVT recurs after such treatment, or these treatments disclose a different form of SVT (such as atrial fibrillation or flutter), it is reasonable to use longer-acting AV nodal blocking agents, such as the nondihydropyridine calcium channel blockers (verapamil and diltiazem) (Class IIa, LOE B) or β-blockers (Class IIa, LOE C).	not reviewed in 2015
2010	Therapy	Therefore, AV nodal blocking drugs should not be used for pre-excited atrial fibrillation or flutter (Class III, LOE C).	not reviewed in 2015
Part 8: Post–Cardiac Arrest Care			
2015	Cardiovascular Care	Coronary angiography should be performed emergently (rather than later in the hospital stay or not at all) for OHCA patients with suspected cardiac etiology of arrest and ST elevation on ECG (Class I, LOE B-NR).	updated for 2015
2015	Cardiovascular Care	Emergent coronary angiography is reasonable for select (e.g. electrically or hemodynamically unstable) adult patients who are comatose after OHCA of suspected cardiac origin but without ST elevation on ECG (Class IIa, LOE B-NR).	updated for 2015
2015	Cardiovascular Care	Coronary angiography is reasonable in post–cardiac arrest patients for whom coronary angiography is indicated regardless of whether the patient is comatose or awake (Class IIa, LOE C-LD).	updated for 2015
2015	Hemodynamic Goals	Avoiding and immediately correcting hypotension (systolic blood pressure less than 90 mm Hg, MAP less than 65 mm Hg) during postresuscitation care may be reasonable (Class IIb, LOE C-LD).	new for 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2015	Targeted Temperature Management	We recommend that comatose (ie, lack of meaningful response to verbal commands) adult patients with ROSC after cardiac arrest have TTM (Class I, LOE B-R for VF/pVT OHCA; Class I, LOE C-EO for non-VF/pVT (ie, "non-shockable") and in-hospital cardiac arrest).	updated for 2015
2015	Targeted Temperature Management	We recommend selecting and maintaining a constant temperature between 32ºC and 36ºC during TTM (Class I, LOE B-R).	updated for 2015
2015	Targeted Temperature Management	It is reasonable that TTM be maintained for at least 24 hours after achieving target temperature (Class IIa, LOE C-EO).	updated for 2015
2015	Targeted Temperature Management	We recommend against the routine prehospital cooling of patients after ROSC with rapid infusion of cold intravenous fluids (Class III: No Benefit, LOE A).	new for 2015
2015	Targeted Temperature Management	It may be reasonable to actively prevent fever in comatose patients after TTM (Class IIb, LOE C-LD).	new for 2015
2015	Other Neurologic Care	An EEG for the diagnosis of seizure should be promptly performed and interpreted, and then should be monitored frequently or continuously in comatose patients after ROSC (Class I, LOE C-LD).	updated for 2015
2015	Other Neurologic Care	The same anticonvulsant regimens for the treatment of status epilepticus caused by other etiologies may be considered after cardiac arrest (Class IIb, LOE C-LD).	updated for 2015
2015	Respiratory Care	Maintaining the Pa_{CO_2} within a normal physiological range, taking into account any temperature correction, may be reasonable (Class IIb, LOE B-NR).	updated for 2015
2015	Respiratory Care	To avoid hypoxia in adults with ROSC after cardiac arrest, it is reasonable to use the highest available oxygen concentration until the arterial oxyhemoglobin saturation or the partial pressure of arterial oxygen can be measured (Class IIa, LOE C-EO).	new for 2015
2015	Respiratory Care	When resources are available to titrate the F_{IO_2} and to monitor oxyhemoglobin saturation, it is reasonable to decrease the F_{IO_2} when oxyhemoglobin saturation is 100%, provided the oxyhemoglobin saturation can be maintained at 94% or greater (Class IIa, LOE C-LD).	updated for 2015
2015	Other Critical Care Interventions	The benefit of any specific target range of glucose management is uncertain in adults with ROSC after cardiac arrest (Class IIb, LOE B-R).	updated for 2015
2015	Prognostication of Outcome	The earliest time for prognostication using clinical examination in patients treated with TTM, where sedation or paralysis could be a confounder. May be 72 hours after normothermia (Class IIb, LOE C-EO).	updated for 2015
2015	Other Critical Care Interventions	We recommend the earliest time to prognosticate a poor neurologic outcome using clinical examination in patients not treated with TTM is 72 hours after cardiac arrest (Class I, LOE B-NR).	new for 2015
2015	Other Critical Care Interventions	This time until prognostication can be even longer than 72 hours after cardiac arrest if the residual effect of sedation or paralysis confounds the clinical examination (Class IIa, LOE C-LD).	new for 2015
2015	Other Critical Care Interventions	In comatose patients who are not treated with TTM, the absence of pupillary reflex to light at 72 hours or more after cardiac arrest is a reasonable exam finding with which to predict poor neurologic outcome (FPR, 0%; 95% CI, 0%–8%; Class IIa, LOE B-NR).	new for 2015
2015	Other Critical Care Interventions	In comatose patients who are treated with TTM, the absence of pupillary reflex to light at 72 hours or more after cardiac arrest is useful to predict poor neurologic outcome (FPR, 1%; 95% CI, 0%–3%; Class I, LOE B-NR).	new for 2015
2015	Other Critical Care Interventions	We recommend that, given their unacceptable FPRs, the findings of either absent motor movements or extensor posturing should not be used alone for predicting a poor neurologic outcome (FPR, 10%; 95% CI, 7%–15% to FPR, 15%; 95% CI, 5%–31%; Class III: Harm, LOE B-NR).	new for 2015
2015	Other Critical Care Interventions	The motor examination may be a reasonable means to identify the population who need further prognostic testing to predict poor outcome (Class IIb, LOE B-NR).	new for 2015
2015	Other Critical Care Interventions	We recommend that the presence of myoclonus, which is distinct from status myoclonus, should not be used to predict poor neurologic outcomes because of the high FPR (FPR, 5%; 95% CI, 3%–8% to FPR, 11%; 95% CI, 3%–26%; Class III: Harm, LOE B-NR).	updated for 2015
2015	Other Critical Care Interventions	In combination with other diagnostic tests at 72 or more hours after cardiac arrest, the presence of status myoclonus during the first 72 hours after cardiac arrest is a reasonable finding to help predict poor neurologic outcomes (FPR, 0%; 95% CI, 0%–4%; Class IIa, LOE B-NR).	new for 2015
2015	Other Critical Care Interventions	In comatose post–cardiac arrest patients who are treated with TTM, it may be reasonable to consider persistent absence of EEG reactivity to external stimuli at 72 hours after cardiac arrest, and persistent burst suppression on EEG after rewarming, to predict a poor outcome (FPR, 0%; 95% CI, 0%–3%; Class IIb, LOE B-NR).	updated for 2015
2015	Other Critical Care Interventions	Intractable and persistent (more than 72 hours) status epilepticus in the absence of EEG reactivity to external stimuli may be reasonable to predict poor outcome (Class IIb, LOE B-NR).	updated for 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2015	Other Critical Care Interventions	In comatose post–cardiac arrest patients who are not treated with TTM, it may be reasonable to consider the presence of burst suppression on EEG at 72 hours or more after cardiac arrest, in combination with other predictors, to predict a poor neurologic outcome (FPR, 1%; 95% CI, 0%–11%; Class IIb, LOE B-NR).	updated for 2015
2015	Other Critical Care Interventions	In patients who are comatose after resuscitation from cardiac arrest regardless of treatment with TTM, it is reasonable to consider bilateral absence of the N20 SSEP wave 24 to 72 hours after cardiac arrest or after rewarming a predictor of poor outcome (FPR, 1%; 95% CI, 0%–3%; Class IIa, LOE B-NR).	updated for 2015
2015	Other Critical Care Interventions	In patients who are comatose after resuscitation from cardiac arrest and not treated with TTM, it may be reasonable to use the presence of a marked reduction of the GWR on brain CT obtained within 2 hours after cardiac arrest to predict poor outcome (Class IIb, LOE B-NR).	new for 2015
2015	Other Critical Care Interventions	It may be reasonable to consider extensive restriction of diffusion on brain MRI at 2 to 6 days after cardiac arrest in combination with other established predictors to predict a poor neurologic outcome (Class IIb, LOE B-NR).	new for 2015
2015	Other Critical Care Interventions	Given the possibility of high FPRs, blood levels of NSE and S-100B should not be used alone to predict a poor neurologic outcome (Class III: Harm, LOE C-LD).	updated for 2015
2015	Other Critical Care Interventions	When performed with other prognostic tests at 72 hours or more after cardiac arrest, it may be reasonable to consider high serum values of NSE at 48 to 72 hours after cardiac arrest to support the prognosis of a poor neurologic outcome (Class IIb, LOE B-NR), especially if repeated sampling reveals persistently high values (Class IIb, LOE C-LD).	updated for 2015
2015	Other Critical Care Interventions	We recommend that all patients who are resuscitated from cardiac arrest but who subsequently progress to death or brain death be evaluated for organ donation (Class I, LOE B-NR).	updated for 2015
2015	Other Critical Care Interventions	Patients who do not have ROSC after resuscitation efforts and who would otherwise have termination of efforts may be considered candidates for kidney or liver donation in settings where programs exist (Class IIb, LOE B-NR).	new for 2015
The following recommendations were not reviewed in 2015. For more information, see the *2010 AHA Guidelines for CPR and ECC*, "Part 9: Post–Cardiac Arrest Care"			
2010	Systems of Care for Improving Post–Cardiac Arrest Outcomes	A comprehensive, structured, multidisciplinary system of care should be implemented in a consistent manner for the treatment of post–cardiac arrest patients (Class I, LOE B).	not reviewed in 2015
2010	Treatment of Pulmonary Embolism After CPR	In post–cardiac arrest patients with arrest due to presumed or known pulmonary embolism, fibrinolytics may be considered (Class IIb, LOE C).	not reviewed in 2015
2010	Sedation After Cardiac Arrest	It is reasonable to consider the titrated use of sedation and analgesia in critically ill patients who require mechanical ventilation or shivering suppression during induced hypothermia after cardiac arrest (Class IIb, LOE C).	not reviewed in 2015
2010	Cardiovascular System	A 12-lead ECG should be obtained as soon as possible after ROSC to determine whether acute ST elevation is present (Class I, LOE B).	not reviewed in 2015
2010	Neuroprotective Drugs	The routine use of coenzyme Q10 in patients treated with hypothermia is uncertain (Class IIb, LOE B).	not reviewed in 2015
2010	Evoked Potentials	Bilateral absence of the N20 cortical response to median nerve stimulation after 24 hours predicts poor outcome in comatose cardiac arrest survivors not treated with therapeutic hypothermia (Class IIa, LOE A).	not reviewed in 2015
Part 9: Acute Coronary Syndromes			
2015	Diagnostic Interventions in ACS	Prehospital 12-lead ECG should be acquired early for patients with possible ACS (Class I, LOE B-NR).	new for 2015
2015	Diagnostic Interventions in ACS	Prehospital notification of the receiving hospital (if fibrinolysis is the likely reperfusion strategy) and/or prehospital activation of the catheterization laboratory should occur for all patients with a recognized STEMI on prehospital ECG (Class I, LOE B-NR).	updated for 2015
2015	Diagnostic Interventions in ACS	Because of high false-negative rates, we recommend that computer-assisted ECG interpretation not be used as a sole means to diagnose STEMI (Class III: Harm, LOE B-NR).	new for 2015
2015	Diagnostic Interventions in ACS	We recommend that computer-assisted ECG interpretation may be used in conjunction with physician or trained provider interpretation to recognize STEMI (Class IIb, LOE C-LD).	updated for 2015
2015	Diagnostic Interventions in ACS	While transmission of the prehospital ECG to the ED physician may improve PPV and therapeutic decision-making regarding adult patients with suspected STEMI, if transmission is not performed, it may be reasonable for trained non-physician ECG interpretation to be used as the basis for decision-making, including activation of the catheterization laboratory, administration of fibrinolysis, and selection of destination hospital. (Class IIa, LOE B-NR).	new for 2015
2015	Diagnostic Interventions in ACS	We recommend against using hs-cTnT and cTnI alone measured at 0 and 2 hours (without performing clinical risk stratification) to exclude the diagnosis of ACS (Class III: Harm, LOE B-NR).	new for 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2015	Diagnostic Interventions in ACS	We recommend that hs-cTnI measurements that are less than the 99th percentile, measured at 0 and 2 hours, may be used together with low-risk stratification (TIMI score of 0 or 1) to predict a less than 1% chance of 30-day MACE (Class IIa, LOE B-NR,).	new for 2015
2015	Diagnostic Interventions in ACS	We recommend that negative cTnI or cTnT measurements at 0 and between 3 and 6 hours may be used together with very low-risk stratification (Vancouver score of 0 or North American Chest Pain score of 0 and age less than 50 years) to predict a less than 1% chance of 30-day MACE (Class IIa, LOE B-NR).	new for 2015
2015	Therapeutic Interventions in ACS	In patients with suspected STEMI intending to undergo primary PCI, initiation of ADP inhibition may be reasonable in either the prehospital or in-hospital setting (Class IIb, LOE C-LD).	new for 2015
2015	Therapeutic Interventions in ACS	We recommend that EMS systems that do not currently administer heparin to suspected STEMI patients do not add this treatment, whereas those that do administer it may continue their current practice (Class IIb, LOE B-NR).	new for 2015
2015	Therapeutic Interventions in ACS	In suspected STEMI patients for whom there is a planned primary PCI reperfusion strategy, administration of unfractionated heparin (UFH) can occur either in the prehospital or in-hospital setting (Class IIb, LOE B-NR).	new for 2015
2015	Therapeutic Interventions in ACS	It may be reasonable to consider the prehospital administration of UFH in STEMI patients or the prehospital administration of bivalirudin in STEMI patients who are at increased risk of bleeding (Class IIb, LOE B-R)	new for 2015
2015	Therapeutic Interventions in ACS	In systems in which UFH is currently administered in the prehospital setting for patients with suspected STEMI who are being transferred for PPCI, it is reasonable to consider prehospital administration of enoxaparin as an alternative to UFH (Class IIa, LOE B-R).	updated for 2015
2015	Therapeutic Interventions in ACS	The usefulness of supplementary oxygen therapy has not been established in normoxic patients. In the prehospital, ED, and hospital settings, the withholding of supplementary oxygen therapy in normoxic patients with suspected or confirmed acute coronary syndrome may be considered (Class IIb, LOE C-LD).	updated for 2015
2015	Therapeutic Interventions in ACS	Where prehospital fibrinolysis is available as part of a STEMI system of care, and in-hospital fibrinolysis is the alternative treatment strategy, it is reasonable to administer prehospital fibrinolysis when transport times are more than 30 minutes (Class IIa, LOE B-R).	updated for 2015
2015	Therapeutic Interventions in ACS	Where prehospital fibrinolysis is available as part of the STEMI system of care and direct transport to a PCI center is available, prehospital triage and transport directly to a PCI center may be preferred because of the small relative decrease in the incidence of intracranial hemorrhage without evidence of mortality benefit to either therapy (Class IIb, LOE B-R).	new for 2015
2015	Therapeutic Interventions in ACS	In the treatment of patients with suspected STEMI, the combined application of fibrinolytic therapy followed by immediate PCI (as contrasted with immediate PCI alone) is not recommended. (Class III: Harm, LOE B-R).	new for 2015
2015	Therapeutic Interventions in ACS	If fibrinolytic therapy is provided, immediate transfer to a PCI center for cardiac angiography within 3 to 24 hours may be considered (Class IIb, LOE C-LD).	new for 2015
2015	Therapeutic Interventions in ACS	Regardless of whether time of symptom onset is known, the interval between first medical contact and reperfusion should not exceed 120 minutes (Class I, LOE C-EO).	new for 2015
2015	Therapeutic Interventions in ACS	In STEMI patients presenting within 2 hours of symptom onset, immediate fibrinolysis rather than PPCI may be considered when the expected delay to PPCI is more than 60 minutes (Class IIb, LOE C-LD).	updated for 2015
2015	Therapeutic Interventions in ACS	In STEMI patients presenting within 2 to 3 hours after symptom onset, either immediate fibrinolysis or PPCI involving a possible delay of 60 to 120 minutes might be reasonable (Class IIb, LOE C-LD).	updated for 2015
2015	Therapeutic Interventions in ACS	In STEMI patients presenting within 3 to 12 hours after symptom onset, performance of PPCI involving a possible delay of up to 120 minutes may be considered rather than initial fibrinolysis (Class IIb, LOE C-LD).	updated for 2015
2015	Therapeutic Interventions in ACS	In STEMI patients when long delays to PPCI are anticipated (more than 120 minutes), a strategy of immediate fibrinolysis followed by routine early (within 3 to 24 hours) angiography and PCI if indicated, is reasonable (Class IIb, LOE B-R).	updated for 2015
2015	Therapeutic Interventions in ACS	In adult patients presenting with STEMI in the ED of a non–PCI-capable hospital, we recommend immediate transfer without fibrinolysis from the initial facility to a PCI center instead of immediate fibrinolysis at the initial hospital with transfer only for ischemia-driven PCI (Class I, LOE B-R).	new for 2015
2015	Therapeutic Interventions in ACS	When STEMI patients cannot be transferred to a PCI-capable hospital in a timely manner, fibrinolytic therapy with routine transfer for angiography may be an acceptable alternative to immediate transfer to PPCI (Class IIb, LOE C-LD).	new for 2015
2015	Therapeutic Interventions in ACS	When fibrinolytic therapy is administered to a STEMI patient in a non–PCI-capable hospital, it may be reasonable to transport all postfibrinolysis patients for early routine angiography in the first 3 to 6 hours and up to 24 hours rather than transport postfibrinolysis patients only when they require ischemia-guided angiography (Class IIb, LOE B-R).	new for 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2015	Hospital Reperfusion Decisions After ROSC	Coronary angiography should be performed emergently (rather than later in the hospital stay or not at all) for OHCA patients with suspected cardiac etiology of arrest and ST elevation on ECG (Class I, LOE B-NR).	updated for 2015
2015	Hospital Reperfusion Decisions After ROSC	Emergency coronary angiography is reasonable for select (e.g. electrically or hemodynamically instable) adult patients who are comatose after OHCA of suspected cardiac origin but without ST elevation on ECG (Class IIa, LOE B-NR).	updated for 2015
2015	Hospital Reperfusion Decisions After ROSC	Coronary angiography is reasonable in post–cardiac arrest patients where coronary angiography is indicated regardless of whether the patient is comatose or awake (Class IIa, LOE C-LD).	updated for 2015
2010	Prehospital ECGs	If providers are not trained to interpret the 12-lead ECG, field transmission of the ECG or a computer report to the receiving hospital is recommended (Class I, LOE B).	not reviewed in 2015
The following recommendations were not reviewed in 2015. For more information, see the *2010 AHA Guidelines for CPR and ECC*, "Part 10: Acute Coronary Syndromes."			
2010	Prehospital Fibrinolysis	It is strongly recommended that systems which administer fibrinolytics in the prehospital setting include the following features: protocols using fibrinolytic checklists, 12-lead ECG acquisition and interpretation, experience in advanced life support, communication with the receiving institution, medical director with training and experience in STEMI management, and continuous quality improvement (Class I, LOE C).	not reviewed in 2015
2010	Prehospital Triage and EMS Hospital Destination	If PCI is the chosen method of reperfusion for the prehospital STEMI patient, it is reasonable to transport patients directly to the nearest PCI facility, bypassing closer EDs as necessary, in systems where time intervals between first medical contact and balloon times are <90 minutes and transport times are relatively short (ie, <30 minutes) (Class IIa, LOE B).	not reviewed in 2015
2010	Focused Assessment and ECG Risk Stratification	This initial evaluation must be efficient because if the patient has STEMI, the goals of reperfusion are to administer fibrinolytics within 30 minutes of arrival (30-minute interval "door-to-drug") or to provide PCI within 90 minutes of arrival (90-minute interval "door-to-balloon") (Class I, LOE A).	not reviewed in 2015
2010	Cardiac Biomarkers	If biomarkers are initially negative within 6 hours of symptom onset, it is recommended that biomarkers should be remeasured between 6 to 12 hours after symptom onset (Class I, LOE A).	not reviewed in 2015
2010	STEMI	If the patient meets the criteria for fibrinolytic therapy, a door-to-needle time (initiation of fibrinolytic agent) <30 minutes is recommended—the earlier the better (Class I, LOE A).	not reviewed in 2015
2010	STEMI	Consultation delays therapy and is associated with increased hospital mortality rates (Class III, LOE B).	not reviewed in 2015
2010	Indicators for Early Invasive Strategies	An early invasive PCI strategy is indicated for patients with non–ST-elevation ACS who have no serious comorbidity and who have coronary lesions amenable to PCI and an elevated risk for clinical events (Class I, LOE A).	not reviewed in 2015
2010	Indicators for Early Invasive Strategies	An early invasive strategy (ie, diagnostic angiography with intent to perform revascularization) is indicated in non–ST-elevation ACS patients who have refractory angina or hemodynamic or electric instability (without serious comorbidities or contraindications to such procedures) (Class I, LOE B).	not reviewed in 2015
2010	Indicators for Early Invasive Strategies	In initially stabilized patients, an initially conservative (ie, a selectively invasive) strategy may be considered as a treatment strategy for non–ST-elevation ACS patients (without serious comorbidities or contraindications to such procedures) who have an elevated risk for clinical events including those with abnormal troponin elevations (Class IIb, LOE B).	not reviewed in 2015
2010	The Chest Pain Unit Model	In patients with suspicion for ACS, normal initial biomarkers, and nonischemic ECG, chest pain observation protocols may be recommended as a safe and effective strategy for evaluating patients in the ED (Class I, LOE A).	not reviewed in 2015
2010	Fibrinolytics	If fibrinolysis is chosen for reperfusion, the ED physician should administer fibrinolytics to eligible patients as early as possible according to a predetermined process of care developed by the ED and cardiology staff (Class I, LOE A).	not reviewed in 2015
2010	Fibrinolytics	In fact, fibrinolytic therapy is generally not recommended for patients presenting between 12 and 24 hours after onset of symptoms based on the results of the LATE and EMERAS trials, unless continuing ischemic pain is present with continuing ST-segment elevation (Class IIb, LOE B).	not reviewed in 2015
2010	Fibrinolytics	Fibrinolytic therapy should not be administered (Class III, LOE B) to patients who present greater than 24 hours after the onset of symptoms.	not reviewed in 2015
2010	Percutaneous Coronary Intervention (PCI)	Coronary angioplasty with or without stent placement is the treatment of choice for the management of STEMI when it can be performed effectively with a door-to-balloon time <90 minutes by a skilled provider (performing >75 PCIs per year) at a skilled PCI facility (performing >200 PCIs annually, of which at least 36 are primary PCI for STEMI) (Class I, LOE A).	not reviewed in 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2010	PCI Following ROSC After Cardiac Arrest	It is reasonable to include cardiac catheterization and coronary angiography in standardized post–cardiac arrest protocols as part of an overall strategy to improve neurologically intact survival in this patient group (Class IIa, LOE B)	not reviewed in 2015
2010	PCI Following ROSC After Cardiac Arrest	Angiography and/or PCI need not preclude or delay other therapeutic strategies including therapeutic hypothermia (Class IIa, LOE B).	not reviewed in 2015
2010	PCI Following ROSC After Cardiac Arrest	A 12-lead ECG should be performed as soon as possible after ROSC (Class I, LOE A).	not reviewed in 2015
2010	PCI Versus Fibrinolytic Therapy	In summary, for patients presenting within 12 hours of symptom onset and electrocardiographic findings consistent with STEMI, reperfusion should be initiated as soon as possible – independent of the method chosen (Class I, LOE A).	not reviewed in 2015
2010	PCI Versus Fibrinolytic Therapy	Primary PCI performed at a high-volume center within 90 minutes of first medical contact by an experienced operator that maintains an appropriate expert status is reasonable, as it improves morbidity and mortality as compared with immediate fibrinolysis (<30 minutes door-to-needle) (Class I, LOE A).	not reviewed in 2015
2010	PCI Versus Fibrinolytic Therapy	For those patients with a contraindication to fibrinolysis, PCI is recommended despite the delay, rather than foregoing reperfusion therapy (Class I, LOE A).	not reviewed in 2015
2010	Clopidogrel	On the basis of these findings, providers should administer a loading dose of clopidogrel in addition to standard care (aspirin, anticoagulants, and reperfusion) for patients determined to have moderate- to high-risk non-ST-segment elevation ACS and STEMI (Class I, LOE A).	not reviewed in 2015
2010	Clopidogrel	It is reasonable to administer a 300-mg oral dose of clopidogrel to ED patients with suspected ACS (without ECG or cardiac marker changes) who are unable to take aspirin because of hypersensitivity or major gastrointestinal intolerance (Class IIa, LOE B).	not reviewed in 2015
2010	Clopidogrel	Providers should administer a 300-mg oral dose of clopidogrel to ED patients up to 75 years of age with STEMI who receive aspirin, heparin, and fibrinolysis (Class I, LOE B).	not reviewed in 2015
2010	Prasugrel	Prasugrel (60 mg oral loading dose) may be substituted for clopidogrel after angiography in patients determined to have non-ST-segment elevation ACS or STEMI who are more than 12 hours after symptom onset prior to planned PCI (Class IIa, LOE B).	not reviewed in 2015
2010	Prasugrel	There is no direct evidence for the use of prasugrel in the ED or prehospital settings. In patients who are not at high risk for bleeding, administration of prasugrel (60-mg oral loading dose) prior to angiography in patients determined to have STEMI ≤12 hours after the initial symptoms may be substituted for administration of clopidogrel (Class IIa, LOE B).	not reviewed in 2015
2010	Initial EMS Care	Because aspirin should be administered as soon as possible after symptom onset to patients with suspected ACS, it is reasonable for EMS dispatchers to instruct patients with no history of aspirin allergy and without signs of active or recent gastrointestinal bleeding to chew an aspirin (160 to 325 mg) while awaiting the arrival of EMS providers (Class IIa, LOE C).	not reviewed in 2015
2010	Initial EMS Care	If the patient is dyspneic, hypoxemic, or has obvious signs of heart failure, providers should titrate therapy, based on monitoring of oxyhemoglobin saturation, to 94% (Class I, LOE C).	not reviewed in 2015
2010	Initial EMS Care	EMS providers should administer nonenteric aspirin (160 [Class I, LOE B] to 325 mg [Class I, LOE C]).	not reviewed in 2015
2010	Initial EMS Care	Morphine is indicated in STEMI when chest discomfort is unresponsive to nitrates (Class I, LOE C);	not reviewed in 2015
2010	Initial EMS Care	Morphine should be used with caution in unstable angina (UA)/NSTEMI due to an association with increased mortality in a large registry (Class IIa, LOE C).	not reviewed in 2015
2010	Interfacility Transfer	These include patients who are ineligible for fibrinolytic therapy or who are in cardiogenic shock (Class I, LOE C).	not reviewed in 2015
2010	Interfacility Transfer	Transfer of high-risk patients who have received primary reperfusion with fibrinolytic therapy is reasonable (Class IIa, LOE B).	not reviewed in 2015
2010	TIMI Risk Score	These findings confirm the value of the TIMI risk score as a guide to therapeutic decisions (Class IIa, LOE B).	not reviewed in 2015
2010	Indicators for Early Invasive Strategies	The decision to implement an initial conservative (versus initial invasive) strategy in these patients may be made by considering physician and patient preference (Class IIb, LOE C).	not reviewed in 2015
2010	Advanced Testing to Detect Coronary Ischemia and CAD	For ED/CPU patients who are suspected of having ACS, have nonischemic ECG's and negative biomarkers, a noninvasive test for inducible myocardial ischemia or anatomic evaluation of the coronary arteries (eg, computed tomography [CT] angiography, cardiac magnetic resonance, myocardial perfusion imaging, stress echocardiography) can be useful in identifying patients suitable for discharge from the ED (Class IIa, LOE B).	not reviewed in 2015
2010	Advanced Testing to Detect Coronary Ischemia and CAD	MPS can also be used for risk stratification, especially in low- to intermediate likelihood of cardiac events according to traditional cardiac markers (Class IIa, LOE B).	not reviewed in 2015

(*Continued*)

2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2010	Advanced Testing to Detect Coronary Ischemia and CAD	The use of MDCT angiography for selected low-risk patients can be useful to allow for safe early discharge from the ED (Class IIa, LOE B).	not reviewed in 2015
2010	Safety of Discharge and Risk of Major Adverse Cardiac Events After Discharge From the ED/CPU	The use of inpatient-derived risk scoring systems are useful for prognosis (Class I, LOE A) but are not recommended to identify patients who may be safely discharged from the ED (Class III, LOE C).	not reviewed in 2015
2010	Aspirin and Nonsteroidal Anti-inflammatory Drugs	Therefore, unless the patient has a known aspirin allergy or active gastrointestinal hemorrhage, nonenteric aspirin should be given as soon as possible to all patients with suspected ACS (Class I, LOE A).	not reviewed in 2015
2010	Aspirin and Nonsteroidal Anti-inflammatory Drugs	NSAIDs (except for aspirin), both nonselective as well as COX-2 selective agents, should not be administered during hospitalization for STEMI because of the increased risk of mortality, reinfarction, hypertension, heart failure, and myocardial rupture associated with their use (Class III, LOE C).	not reviewed in 2015
2010	Nitroglycerin (or Glyceryl Trinitrate)	Patients with ischemic discomfort should receive up to 3 doses of sublingual or aerosol nitroglycerin at 3- to 5-minute intervals until pain is relieved or low blood pressure limits its use (Class I, LOE B).	not reviewed in 2015
2010	Nitroglycerin (or Glyceryl Trinitrate)	The use of nitrates in patients with hypotension (SBP <90 mm Hg or ≥30 mm Hg below baseline), extreme bradycardia (<50 bpm), or tachycardia in the absence of heart failure (>100 bpm) and in patients with right ventricular infarction is contraindicated (Class III, LOE C).	not reviewed in 2015
2010	Analgesia	Providers should administer analgesics, such as intravenous morphine, for chest discomfort unresponsive to nitrates. Morphine is the preferred analgesic for patients with STEMI (Class I, LOE C).	not reviewed in 2015
2010	β-Adrenergic Receptor Blockers	IV β-blocker therapy may be considered as reasonable in specific situations such as severe hypertension or tachyarrhythmias in patients without contraindications (Class IIa, LOE B).	not reviewed in 2015
2010	β-Adrenergic Receptor Blockers	In the absence of contraindications, PO β-blockers should be administered within the first 24 hours to patients with suspected ACS (Class I, LOE A).	not reviewed in 2015
2010	β-Adrenergic Receptor Blockers	It is reasonable to start oral β-blockers with low doses after the patient is stabilized prior to discharge (Class IIa, LOE B).	not reviewed in 2015
2010	Treatment Recommendations for UA/NSTEMI	For in-hospital patients with NSTEMI managed with a planned initial conservative approach, either fondaparinux (Class IIa, LOE B) or enoxaparin (Class IIa, LOE A) are reasonable alternatives to UFH or placebo.	not reviewed in 2015
2010	Treatment Recommendations for UA/NSTEMI	For in-hospital patients with NSTEMI managed with a planned invasive approach, either enoxaparin or UFH are reasonable choices (Class IIa, LOE A).	not reviewed in 2015
2010	Treatment Recommendations for UA/NSTEMI	Fondaparinux may be used in the setting of PCI, but requires co-administration of UFH and does not appear to offer an advantage over UFH alone (Class IIb, LOE A).	not reviewed in 2015
2010	Treatment Recommendations for UA/NSTEMI	For in-hospital patients with NSTEMI and renal insufficiency, bivalirudin or UFH may be considered (Class IIb, LOE A).	not reviewed in 2015
2010	Treatment Recommendations for UA/NSTEMI	For in-hospital patients with NSTEMI and increased bleeding risk, where anticoagulant therapy is not contraindicated, fondaparinux (Class IIa, LOE B) or bivalirudin (Class IIa, LOE A) are reasonable and UFH may be considered (Class IIb, LOE C)	not reviewed in 2015
2010	Enoxaparin	For patients with STEMI managed with fibrinolysis in the hospital, it is reasonable to administer enoxaparin instead of UFH (Class IIa, LOE A).	not reviewed in 2015
2010	Enoxaparin	In addition, for prehospital patients with STEMI managed with fibrinolysis, adjunctive enoxaparin instead of UFH may be considered (Class IIb, LOE A).	not reviewed in 2015
2010	Enoxaparin	Patients initially treated with enoxaparin should not be switched to UFH and vice versa because of increased risk of bleeding (Class III, LOE C).	not reviewed in 2015
2010	Enoxaparin	In younger patients <75 years the initial dose of enoxaparin is 30 mg IV bolus followed by 1 mg/kg SC every 12 hours (first SC dose shortly after the IV bolus) (Class IIb, LOE A).	not reviewed in 2015
2010	Enoxaparin	Patients ≥75 years may be treated with 0.75 mg/kg SC enoxaparin every 12 hours without an initial IV bolus (Class IIb, LOE B).	not reviewed in 2015
2010	Enoxaparin	Patients with impaired renal function (creatinine clearance <30 mL/min) may be given 1 mg/kg enoxaparin SC once daily (Class IIb, LOE B).	not reviewed in 2015
2010	Enoxaparin	Patients with known impaired renal function may alternatively be managed with UFH (Class IIb, LOE B).	not reviewed in 2015
2010	Fondaparinux	Fondaparinux (initially 2.5 mg IV followed by 2.5 mg SC once daily) may be considered in the hospital for patients treated specifically with non-fibrin-specific thrombolytics (ie, streptokinase), provided the creatinine is 3 mg/dL (Class IIb, LOE B).	not reviewed in 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2010	Unfractionated Heparin Versus Low-Molecular-Weight Heparin With PPCI in STEMI	For patients with STEMI undergoing contemporary PCI (ie, additional broad use of glycoprotein IIb/IIIa inhibitors and a thienopyridine) enoxaparin may be considered a safe and effective alternative to UFH (Class IIb, LOE B).	not reviewed in 2015
2010	Unfractionated Heparin Versus Low-Molecular-Weight Heparin With PPCI in STEMI	Patients initially treated with enoxaparin should not be switched to UFH and vice versa to avoid increased risk of bleeding. Fondaparinux may be considered as an alternative to UFH, however, there is an increased risk of catheter thrombi with fondaparinux alone. Additional UFH (50 to 100 U/kg bolus) may help to avoid this complication (Class IIb, LOE B), but using these two agents is not recommended over UFH alone.	not reviewed in 2015
2010	Unfractionated Heparin Versus Low-Molecular-Weight Heparin With PPCI in STEMI	For fondaparinux and enoxaparin it is necessary to adjust the dose in patients with renal impairment. Bivalirudin may be considered as an alternative to UFH and GP IIb/IIIa inhibitors (Class IIb, LOE A).	not reviewed in 2015
2010	ACE Inhibitors and ARBs in the Hospital	Administration of an oral ACE inhibitor is recommended within the first 24 hours after onset of symptoms in STEMI patients with pulmonary congestion or LV ejection fraction <40%, in the absence of hypotension (SBP <100 mm Hg or ≥30 mm Hg below baseline) (Class I, LOE A).	not reviewed in 2015
2010	ACE Inhibitors and ARBs in the Hospital	Oral ACE inhibitor therapy can also be useful for all other patients with AMI with or without early reperfusion therapy (Class IIa, LOE B).	not reviewed in 2015
2010	ACE Inhibitors and ARBs in the Hospital	IV administration of ACE inhibitors is contraindicated in the first 24 hours because of risk of hypotension (Class III, LOE C).	not reviewed in 2015
2010	ACE Inhibitors in the Prehospital Setting	In conclusion, although ACE inhibitors and ARBs have been shown to reduce long-term risk of mortality in patients suffering an AMI, there is insufficient evidence to support the routine initiation of ACE inhibitors and ARBs in the prehospital or ED setting (Class IIb, LOE C).	not reviewed in 2015
2010	HMG Coenzyme A Reductase Inhibitors (Statins)	There is little data to suggest that this therapy should be initiated within the ED; however, early initiation (within 24 hours of presentation) of statin therapy is recommended in patients with an ACS or AMI (Class I, LOE C).	not reviewed in 2015
2010	HMG Coenzyme A Reductase Inhibitors (Statins)	If patients are already on statin therapy, continue the therapy (Class IIb, LOE C).	not reviewed in 2015
2010	HMG Coenzyme A Reductase Inhibitors (Statins)	Statins should not be discontinued during the index hospitalization unless contraindicated (Class III, LOE C).	not reviewed in 2015
2010	HMG Coenzyme A Reductase Inhibitors (Statins)	In conclusion, intensive (target LDL values optimally 70 mg/dL) statin treatment should be initiated within the first 24 hours after onset of an ACS event (eg, immediately after hospital admission) in all patients presenting with any form of ACS unless strictly contraindicated (eg, by proven intolerance) (Class I, LOE A).	not reviewed in 2015
2010	Glucose-Insulin-Potassium	At this time there is little evidence to suggest that this intervention is helpful (Class IIb, LOE C).	not reviewed in 2015
2010	Ventricular Rhythm Disturbances	The practice of prophylactic administration of lidocaine is not recommended (Class III, LOE A).	not reviewed in 2015
2010	Ventricular Rhythm Disturbances	Sotalol has not been adequately studied (Class IIb, LOE C).	not reviewed in 2015
2010	Ventricular Rhythm Disturbances	Amiodarone in a single RCT did not appear to improve survival in low doses and may increase mortality in high doses when used early in patients with suspected myocardial infarction (Class IIb, LOE C).	not reviewed in 2015
2010	Ventricular Rhythm Disturbances	Prophylactic antiarrhythmics are not recommended for patients with suspected ACS or myocardial infarction in the prehospital or ED (Class III, LOE A).	not reviewed in 2015
2010	Ventricular Rhythm Disturbances	Routine IV administration of β-blockers to patients without hemodynamic or electric contraindications is associated with a reduced incidence of primary VF (Class IIb, LOE C).	not reviewed in 2015
2010	Ventricular Rhythm Disturbances	It is prudent clinical practice to maintain serum potassium >4 mEq/L and magnesium >2 mEq/L (Class IIB, LOE A).	not reviewed in 2015
Part 10: Special Circumstances of Resuscitation			
2015	Cardiac Arrest Associated With Pregnancy	Priorities for the pregnant woman in cardiac arrest are provision of high-quality CPR and relief of aortocaval compression (Class I, LOE C-LD).	new for 2015
2015	Cardiac Arrest Associated With Pregnancy	If the fundus height is at or above the level of the umbilicus, manual LUD can be beneficial in relieving aortocaval compression during chest compressions (Class IIa, LOE C-LD).	new for 2015
2015	Cardiac Arrest Associated With Pregnancy	Because immediate ROSC cannot always be achieved, local resources for a PMCD should be summoned as soon as cardiac arrest is recognized in a woman in the second half of pregnancy (Class I, LOE C-LD).	new for 2015
2015	Cardiac Arrest Associated With Pregnancy	Systematic preparation and training are the keys to a successful response to such rare and complex events. Care teams that may be called upon to manage these situations should develop and practice standard institutional responses to allow for smooth delivery of resuscitative care (Class I, LOE C-EO).	new for 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2015	Cardiac Arrest Associated With Pregnancy	During cardiac arrest, if the pregnant woman with a fundus height at or above the umbilicus has not achieved ROSC with usual resuscitation measures plus manual LUD, it is advisable to prepare to evacuate the uterus while resuscitation continues (Class I, LOE C-LD).	new for 2015
2015	Cardiac Arrest Associated With Pregnancy	In situations such as nonsurvivable maternal trauma or prolonged pulselessness, in which maternal resuscitative efforts are obviously futile, there is no reason to delay performing PMCD (Class I, LOE C-LD).	new for 2015
2015	Cardiac Arrest Associated With Pregnancy	PMCD should be considered at 4 minutes after onset of maternal cardiac arrest or resuscitative efforts (for the unwitnessed arrest) if there is no ROSC (Class IIa, LOE C-EO).	updated for 2015
2015	Cardiac Arrest Associated With Pulmonary Embolism	In patients with confirmed PE as the precipitant of cardiac arrest, thrombolysis, surgical embolectomy, and mechanical embolectomy are reasonable emergency treatment options (Class IIa, LOE C-LD).	new for 2015
2015	Cardiac Arrest Associated With Pulmonary Embolism	Thrombolysis can be beneficial even when chest compressions have been provided (Class IIa, LOE C-LD).	new for 2015
2015	Cardiac Arrest Associated With Pulmonary Embolism	Thrombolysis may be considered when cardiac arrest is suspected to be caused by PE (Class IIb, LOE C-LD).	updated for 2015
2015	Cardiac or Respiratory Arrest Associated With Opioid Overdose	It is reasonable to provide opioid overdose response education, either alone or coupled with naloxone distribution and training, to persons at risk for opioid overdose (Class IIa, LOE C-LD).	new for 2015
2015	Cardiac or Respiratory Arrest Associated With Opioid Overdose	It is reasonable to base this training on first aid and non–healthcare provider BLS recommendations rather than on more advanced practices intended for healthcare providers (Class IIa, LOE C-EO).	new for 2015
2015	Cardiac or Respiratory Arrest Associated With Opioid Overdose	Empiric administration of IM or IN naloxone to all unresponsive opioid-associated life-threatening emergency patients may be reasonable as an adjunct to standard first aid and non–healthcare provider BLS protocols (Class IIb, LOE C-EO).	new for 2015
2015	Cardiac or Respiratory Arrest Associated With Opioid Overdose	Victims who respond to naloxone administration should access advanced healthcare services (Class I, LOE C-EO).	new for 2015
2015	Cardiac or Respiratory Arrest Associated With Opioid Overdose	For patients with known or suspected opioid addiction who have a definite pulse but no normal breathing or only gasping (ie, a respiratory arrest), in addition to providing standard BLS care, it is reasonable for appropriately trained BLS healthcare providers to administer IM or IN naloxone (Class IIa, LOE C-LD).	new for 2015
2015	Cardiac or Respiratory Arrest Associated With Opioid Overdose	Standard resuscitative measures should take priority over naloxone administration (Class I, LOE C-EO), with a focus on high-quality CPR (compressions plus ventilation).	new for 2015
2015	Cardiac or Respiratory Arrest Associated With Opioid Overdose	It may be reasonable to administer IM or IN naloxone based on the possibility that the patient is not in cardiac arrest (Class IIb, LOE C-EO).	new for 2015
2015	Cardiac or Respiratory Arrest Associated With Opioid Overdose	Responders should not delay access to more-advanced medical services while awaiting the patient's response to naloxone or other interventions (Class I, LOE C-EO).	new for 2015
2015	Cardiac or Respiratory Arrest Associated With Opioid Overdose	Unless the patient refuses further care, victims who respond to naloxone administration should access advanced healthcare services (Class I, LOE C-EO).	new for 2015
2015	Cardiac or Respiratory Arrest Associated With Opioid Overdose	Bag-mask ventilation should be maintained until spontaneous breathing returns, and standard ACLS measures should continue if return of spontaneous breathing does not occur (Class I, LOE C-LD).	new for 2015
2015	Cardiac or Respiratory Arrest Associated With Opioid Overdose	After ROSC or return of spontaneous breathing, patients should be observed in a healthcare setting until the risk of recurrent opioid toxicity is low and the patient's level of consciousness and vital signs have normalized (Class I, LOE C-LD).	new for 2015
2015	Cardiac or Respiratory Arrest Associated With Opioid Overdose	If recurrent opioid toxicity develops, repeated small doses or an infusion of naloxone can be beneficial in healthcare settings (Class IIa, LOE C-LD).	new for 2015
2015	Cardiac or Respiratory Arrest Associated With Opioid Overdose	Naloxone administration in post–cardiac arrest care may be considered in order to achieve the specific therapeutic goals of reversing the effects of long-acting opioids (Class IIb, LOE C-EO).	new for 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2015	Role of Intravenous Lipid Emulsion Therapy in Management of Cardiac Arrest Due to Poisoning	It may be reasonable to administer ILE, concomitant with standard resuscitative care, to patients with local anesthetic systemic toxicity and particularly to patients who have premonitory neurotoxicity or cardiac arrest due to bupivacaine toxicity (Class IIb, LOE C-EO).	new for 2015
2015	Role of Intravenous Lipid Emulsion Therapy in Management of Cardiac Arrest Due to Poisoning	It may be reasonable to administer ILE to patients with other forms of drug toxicity who are failing standard resuscitative measures (Class IIb, LOE C-EO).	updated for 2015
2015	Cardiac Arrest During Percutaneous Coronary Intervention	It may be reasonable to use mechanical CPR devices to provide chest compressions to patients in cardiac arrest during PCI (Class IIb, LOE C-EO).	updated for 2015
2015	Cardiac Arrest During Percutaneous Coronary Intervention	It may be reasonable to use ECPR as a rescue treatment when initial therapy is failing for cardiac arrest that occurs during PCI (Class IIb, LOE C-LD).	new for 2015
2015	Cardiac Arrest During Percutaneous Coronary Intervention	Institutional guidelines should include the selection of appropriate candidates for use of mechanical support devices to ensure that these devices are used as a bridge to recovery, surgery or transplant, or other device (Class I, LOE C-EO).	new for 2015
The following recommendations were not reviewed in 2015. For more information, see the *2010 AHA Guidelines for CPR and ECC*, "Part 12: Cardiac Arrest in Special Situations."			
2010	Cardiac Arrest Associated With Asthma	Therefore, since the effects of auto-PEEP in an asthmatic patient with cardiac arrest are likely quite severe, a ventilation strategy of low respiratory rate and tidal volume is reasonable (Class IIa, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Asthma	During arrest a brief disconnection from the bag mask or ventilator may be considered, and compression of the chest wall to relieve air-trapping can be effective (Class IIa, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Asthma	For all asthmatic patients with cardiac arrest, and especially for patients in whom ventilation is difficult, the possible diagnosis of a tension pneumothorax should be considered and treated (Class I, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Anaphylaxis	Given the potential for the rapid development of oropharyngeal or laryngeal edema, immediate referral to a health professional with expertise in advanced airway placement is recommended (Class I, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Anaphylaxis	Epinephrine should be administered early by IM injection to all patients with signs of a systemic allergic reaction, especially hypotension, airway swelling, or difficulty breathing (Class I, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Anaphylaxis	The recommended dose is 0.2 to 0.5 mg (1:1000) IM to be repeated every 5 to 15 minutes in the absence of clinical improvement (Class I, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Anaphylaxis	In both anaphylaxis and cardiac arrest the immediate use of an epinephrine autoinjector is recommended if available (Class I, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Anaphylaxis	Planning for advanced airway management, including a surgical airway, is recommended (Class I, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Anaphylaxis	Vasogenic shock from anaphylaxis may require aggressive fluid resuscitation (Class IIa, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Anaphylaxis	When an IV line is in place, it is reasonable to consider the IV route as an alternative to IM administration of epinephrine in anaphylactic shock (Class IIa, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Anaphylaxis	Because fatal overdose of epinephrine has been reported, close hemodynamic monitoring is recommended (Class I, LOE B).	not reviewed in 2015
2010	Cardiac Arrest Associated With Anaphylaxis	IV infusion of epinephrine is a reasonable alternative to IV boluses for treatment of anaphylaxis in patients not in cardiac arrest (Class IIa, LOE C) and may be considered in postarrest management (Class IIb, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Anaphylaxis	Alternative vasoactive drugs (vasopressin, norepinephrine, methoxamine, and metaraminol) may be considered in cardiac arrest secondary to anaphylaxis that does not respond to epinephrine (Class IIb, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Anaphylaxis	Adjuvant use of antihistamines (H1 and H2 antagonist), inhaled β-adrenergic agents, and IV corticosteroids has been successful in management of the patient with anaphylaxis and may be considered in cardiac arrest due to anaphylaxis (Class IIb, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Anaphylaxis	Cardiopulmonary bypass has been successful in isolated case reports of anaphylaxis followed by cardiac arrest. Use of these advanced techniques may be considered in clinical situations where the required professional skills and equipment are immediately available (Class IIb, LOE C).	not reviewed in 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2010	Cardiac Arrest Associated With Pregnancy	Bag-mask ventilation with 100% oxygen before intubation is especially important in pregnancy (Class IIa, LOE B).	not reviewed in 2015
2010	Cardiac Arrest Associated With Pregnancy	If internal or external fetal monitors are attached during cardiac arrest in a pregnant woman, it is reasonable to remove them (Class IIb, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Pregnancy	Team planning should be done in collaboration with the obstetric, neonatal, emergency, anesthesiology, intensive care, and cardiac arrest services (Class I, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Pregnancy	During therapeutic hypothermia of the pregnant patient, it is recommended that the fetus be continuously monitored for bradycardia as a potential complication, and obstetric and neonatal consultation should be sought (Class I, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Pulmonary Embolism	In patients with cardiac arrest and without known PE, routine fibrinolytic treatment given during CPR shows no benefit and is not recommended (Class III, LOE A).	not reviewed in 2015
2010	Cardiac Arrest Associated With Life-Threatening Electrolyte Disturbances	When cardiac arrest occurs secondary to hyperkalemia, it may be reasonable to administer adjuvant IV therapy as outlined above for cardiotoxicity in addition to standard ACLS (Class IIb, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Life-Threatening Electrolyte Disturbances	The effect of bolus administration of potassium for cardiac arrest suspected to be secondary to hypokalemia is unknown and ill advised (Class III, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Life-Threatening Electrolyte Disturbances	Administration of calcium (calcium chloride [10%] 5 to 10 mL or calcium gluconate [10%] 15 to 30 mL IV over 2 to 5 minutes) may be considered during cardiac arrest associated with hypermagnesemia (Class IIb, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Life-Threatening Electrolyte Disturbances	For cardiotoxicity and cardiac arrest, IV magnesium 1 to 2 g of MgSO4 bolus IV push is recommended (Class I, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Life-Threatening Electrolyte Disturbances	Empirical use of calcium (calcium chloride [10%] 5 to 10 mL OR calcium gluconate [10%] 15 to 30 mL IV over 2 to 5 minutes) may be considered when hyperkalemia or hypermagnesemia is suspected as the cause of cardiac arrest (Class IIb, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Toxic Ingestions	The administration of flumazenil to patients with undifferentiated coma confers risk and is not recommended (Class III, LOE B).	not reviewed in 2015
2010	Cardiac Arrest Associated With Toxic Ingestions	The recommended dose of glucagon is a bolus of 3 to 10 mg, administered slowly over 3 to 5 minutes, followed by an infusion of 3 to 5 mg/h (0.05 to 0.15 mg/kg followed by an infusion of 0.05 to 0.10 mg/kg per hour) (Class IIb, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Toxic Ingestions	Administration of high-dose insulin in patients with shock refractory to other measures may be considered (Class IIb, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Toxic Ingestions	Administration of calcium in patients with shock refractory to other measures may be considered (Class IIb, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Toxic Ingestions	High-dose insulin, in the doses listed in the β-blocker section above, may be effective for restoring hemodynamic stability and improving survival in the setting of severe cardiovascular toxicity associated with toxicity from a calcium channel blocker overdose (Class IIb, LOE B).	not reviewed in 2015
2010	Cardiac Arrest Associated With Toxic Ingestions	Administration of calcium in patients with shock refractory to other measures may be considered (Class IIb, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Toxic Ingestions	Antidigoxin Fab antibodies should be administered to patients with severe life-threatening cardiac glycoside toxicity (Class I, LOE B).	not reviewed in 2015
2010	Cardiac Arrest Associated With Toxic Ingestions	It may be reasonable to try agents that have shown efficacy in the management of acute coronary syndrome in patients with severe cardiovascular toxicity. β-Blockers (phentolamine), benzodiazepines (lorazepam, diazepam), calcium channel blockers (verapamil), morphine, and sublingual nitroglycerin may be used as needed to control hypertension, tachycardia, and agitation (Class IIb, LOE B).	not reviewed in 2015
2010	Cardiac Arrest Associated With Toxic Ingestions	The available data do not support the use of 1 agent over another in the treatment of cardiovascular toxicity due to cocaine (Class IIb, LOE B).	not reviewed in 2015
2010	Cardiac Arrest Associated With Toxic Ingestions	For cocaine-induced hypertension or chest discomfort, benzodiazepines, nitroglycerin, and/or morphine can be beneficial (Class IIa, LOE B).	not reviewed in 2015
2010	Cardiac Arrest Associated With Toxic Ingestions	Although contradictory evidence exists, current recommendations are that pure β-blocker medications in the setting of cocaine are not indicated (Class IIb, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Toxic Ingestions	Administration of sodium bicarbonate for cardiac arrest due to cyclic antidepressant overdose may be considered (Class IIb, LOE C).	not reviewed in 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2010	Cardiac Arrest Associated With Toxic Ingestions	Sodium bicarbonate boluses of 1 mL/kg may be administered as needed to achieve hemodynamic stability (adequate mean arterial blood pressure and perfusion) and QRS narrowing (Class IIb, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Toxic Ingestions	Because hyperbaric oxygen therapy appears to confer little risk, the available data suggest that hyperbaric oxygen therapy may be helpful in treatment of acute carbon monoxide poisoning in patients with severe toxicity (Class IIb, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Associated With Toxic Ingestions	Based on the best evidence available, a treatment regimen of 100% oxygen and hydroxocobalamin, with or without sodium thiosulfate, is recommended (Class I, LOE B).	not reviewed in 2015
2010	Cardiac Arrest in Accidental Hypothermia	It may be reasonable to perform further defibrillation attempts according to the standard BLS algorithm concurrent with rewarming strategies (Class IIb, LOE C).	not reviewed in 2015
2010	Cardiac Arrest in Accidental Hypothermia	It may be reasonable to consider administration of a vasopressor during cardiac arrest according to the standard ACLS algorithm concurrent with rewarming strategies (Class IIb, LOE C).	not reviewed in 2015
2010	Cardiac Arrest in Avalanche Victims	Full resuscitative measures, including extracorporeal rewarming when available, are recommended for all avalanche victims without the characteristics outlined above that deem them unlikely to survive or with any obvious lethal traumatic injury (Class I, LOE C).	not reviewed in 2015
2010	Drowning	All victims of drowning who require any form of resuscitation (including rescue breathing alone) should be transported to the hospital for evaluation and monitoring, even if they appear to be alert and demonstrate effective cardiorespiratory function at the scene (Class I, LOE C).	not reviewed in 2015
2010	Drowning	Routine stabilization of the cervical spine in the absence of circumstances that suggest a spinal injury is not recommended (Class III, LOE B).	not reviewed in 2015
2010	Drowning	The routine use of abdominal thrusts or the Heimlich maneuver for drowning victims is not recommended (Class III, LOE C).	not reviewed in 2015
2010	Cardiac Arrest During Percutaneous Coronary Intervention	It is reasonable to use cough CPR during PCI (Class IIa, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Caused by Cardiac Tamponade	In the arrest setting, in the absence of echocardiography, emergency pericardiocentesis without imaging guidance can be beneficial (Class IIa, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Caused by Cardiac Tamponade	Emergency department thoracotomy may improve survival compared with pericardiocentesis in patients with pericardial tamponade secondary to trauma who are in cardiac arrest or who are prearrest, especially if gross blood causes clotting that blocks a pericardiocentesis needle (Class IIb, LOE C).	not reviewed in 2015
2010	Cardiac Arrest Following Cardiac Surgery	For patients with cardiac arrest following cardiac surgery, it is reasonable to perform resternotomy in an appropriately staffed and equipped intensive care unit (Class IIa, LOE B).	not reviewed in 2015
2010	Cardiac Arrest Following Cardiac Surgery	Despite rare case reports describing damage to the heart possibly due to external chest compressions, chest compressions should not be withheld if emergency resternotomy is not immediately available (Class IIa, LOE C).	not reviewed in 2015
Part 11: Pediatric Basic Life Support and Cardiopulmonary Resuscitation Quality			
2015	Sequence of CPR	Because of the limited amount and quality of the data, it may be reasonable to maintain the sequence from the 2010 Guidelines by initiating CPR with C-A-B over A-B-C (Class IIb, LOE C-EO). Knowledge gaps exist, and specific research will be required to examine the best approach to initiating CPR in children.	updated for 2015
2015	Components of High-Quality CPR: Chest Compression Rate and Depth	To maximize simplicity in CPR training, in the absence of sufficient pediatric evidence, it is reasonable to use the adult chest compression rate of 100/min to 120/min for infants and children (Class IIa, LOE C-EO).	updated for 2015
2015	Components of High-Quality CPR: Chest Compression Rate and Depth	Although the effectiveness of CPR feedback devices was not reviewed by this writing group, the consensus of the group is that the use of feedback devices likely helps the rescuer optimize adequate chest compression rate and depth, and we suggest their use when available (Class IIb, LOE C-EO).	updated for 2015
2015	Components of High-Quality CPR: Chest Compression Rate and Depth	It is reasonable that in pediatric patients (less than 1 year) rescuers provide chest compressions that depress the chest at least one third the anterior-posterior diameter of the chest. This equates to approximately 1.5 inches (4 cm) in infants to 2 inches (5 cm) in children. (Class IIa, LOE C-LD). Once children have reached puberty, the recommended adult compression depth of at least 5 cm, but no more than 6 cm, is used for the adolescent of average adult size.	updated for 2015
2015	Components of High-Quality CPR: Compression-Only CPR	Conventional CPR (rescue breathing and chest compressions) should be provided for pediatric cardiac arrests (Class I, LOE B-NR).	updated for 2015
2015	Components of High-Quality CPR: Compression-Only CPR	The asphyxial nature of the majority of pediatric cardiac arrests necessitates ventilation as part of effective CPR. However, because compression-only CPR is effective in patients with a primary cardiac event, if rescuers are unwilling or unable to deliver breaths, we recommend rescuers perform compression-only CPR for infants and children in cardiac arrest (Class I, LOE B-NR).	updated for 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
The following recommendations were not reviewed in 2015. For more information, see the *2010 AHA Guidelines for CPR and ECC*, "Part 13: Pediatric Basic Life Support."			
2010	Check for Breathing	Formal training as well as "just in time" training, such as that provided by an emergency response system dispatcher, should emphasize how to recognize the difference between gasping and normal breathing; rescuers should be instructed to provide CPR even when the unresponsive victim has occasional gasps (Class IIa, LOE C).	not reviewed in 2015
2010	Start Chest Compressions	For an infant, lone rescuers (whether lay rescuers or healthcare providers) should compress the sternum with 2 fingers placed just below the intermammary line (Class IIb, LOE C).	not reviewed in 2015
2010	Start Chest Compressions	There are no data to determine if the 1- or 2-hand method produces better compressions and better outcome (Class IIb, LOE C), because children and rescuers come in all sizes, rescuers may use either 1 or 2 hands to compress the child's chest.	not reviewed in 2015
2010	Start Chest Compressions	After each compression, allow the chest to recoil completely (Class IIb, LOE B) because complete chest reexpansion improves the flow of blood returning to the heart and thereby blood flow to the body during CPR.	not reviewed in 2015
2010	Open the Airway and Give Ventilations	Open the airway using a head tilt–chin lift maneuver for both injured and noninjured victims (Class I, LOE B).	not reviewed in 2015
2010	Open the Airway and Give Ventilations	In an infant, if you have difficulty making an effective seal over the mouth and nose, try either mouth-to-mouth or mouth-to-nose ventilation (Class IIb, LOE C).	not reviewed in 2015
2010	Open the Airway and Give Ventilations	In either case make sure the chest rises when you give a breath. If you are the only rescuer, provide 2 effective ventilations using as short a pause in chest compressions as possible after each set of 30 compressions (Class IIa, LOE C).	not reviewed in 2015
2010	BLS Sequence for Healthcare Providers and Others Trained in 2-Rescuer CPR	It is reasonable for healthcare providers to tailor the sequence of rescue actions to the most likely cause of arrest. For example, if the arrest is witnessed and sudden (eg, sudden collapse in an adolescent or a child identified at high risk for arrhythmia or during an athletic event), the healthcare provider may assume that the victim has suffered a sudden VF–cardiac arrest and as soon as the rescuer verifies that the child is unresponsive and not breathing (or only gasping) the rescuer should immediately phone the emergency response system, get the AED and then begin CPR and use the AED. (Class IIa, LOE C).	not reviewed in 2015
2010	Pulse Check	If, within 10 seconds, you don't feel a pulse or are not sure if you feel a pulse, begin chest compressions (Class IIa, LOE C).	not reviewed in 2015
2010	Inadequate Breathing With Pulse	Reassess the pulse about every 2 minutes (Class IIa, LOE B) but spend no more than 10 seconds doing so.	not reviewed in 2015
2010	Ventilations	For healthcare providers and others trained in two person CPR, if there is evidence of trauma that suggests spinal injury, use a jaw thrust without head tilt to open the airway (Class IIb, LOE C).	not reviewed in 2015
2010	Coordinate Chest Compressions and Ventilations	Deliver ventilations with minimal interruptions in chest compressions (Class IIa, LOE C).	not reviewed in 2015
2010	Defibrillation	For infants a manual defibrillator is preferred when a shockable rhythm is identified by a trained healthcare provider (Class IIb, LOE C).	not reviewed in 2015
2010	Defibrillation	An AED with a pediatric attenuator is also preferred for children <8 year of age. If neither is available, an AED without a dose attenuator may be used (Class IIb, LOE C).	not reviewed in 2015
2010	Bag-Mask Ventilation (Healthcare Providers)	Avoid excessive ventilation (Class III, LOE C); use only the force and tidal volume necessary to just make the chest rise.	not reviewed in 2015
Part 12: Pediatric Advanced Life Support			
2015	Prearrest Care Updates	Pediatric medical emergency team/rapid response team systems may be considered in facilities where children with high-risk illnesses are cared for on general in-patient units (Class IIb, LOE C-LD).	updated for 2015
2015	Prearrest Care Updates	The use of PEWS may be considered, but its effectiveness in the in-hospital setting is not well established (Class IIb, LOE C-LD).	new for 2015
2015	Prearrest Care Updates	Administration of an initial fluid bolus of 20 mL/kg to infants and children with shock is reasonable, including those with conditions such as severe sepsis (Class IIa, LOE C-LD) malaria and Dengue (Class IIb, LOE B-R).	new for 2015
2015	Prearrest Care Updates	When caring for children with severe febrile illness (such as those included in the FEAST trial), in settings with limited access to critical care resources (ie, mechanical ventilation and inotropic support), administration of bolus intravenous fluids should be undertaken with extreme caution because it may be harmful (Class IIb, LOE B-R).	new for 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2015	Prearrest Care Updates	Providers should reassess the patient after every fluid bolus (Class I, LOE C-EO).	new for 2015
2015	Prearrest Care Updates	Either isotonic crystalloids or colloids can be effective as the initial fluid choice for resuscitation (Class IIa, LOE B-R).	new for 2015
2015	Prearrest Care Updates	The available evidence does not support the routine use of atropine preintubation of critically ill infants and children. It may be reasonable for practitioners to use atropine as a premedication in specific emergent intubations when there is higher risk of bradycardia (eg, when giving succinylcholine as a neuromuscular blocker to facilitate intubation) (Class IIb, LOE C-LD).	new for 2015
2015	Prearrest Care Updates	A dose of 0.02 mg/kg of atropine with no minimum dose may be considered when atropine is used as a premedication for emergency intubation (Class IIb, LOE C-LD).	new for 2015
2015	Prearrest Care Updates	Venoarterial ECMO use may be considered in patients with acute fulminant myocarditis who are at high risk of imminent cardiac arrest (Class IIb, LOE C-EO).	new for 2015
2015	Intra-arrest Care Updates	ECPR may be considered for pediatric patients with cardiac diagnoses who have IHCA in settings with existing ECMO protocols, expertise, and equipment (Class IIb, LOE C-LD).	new for 2015
2015	Intra-arrest Care Updates	$ETCO_2$ monitoring may be considered to evaluate the quality of chest compressions, but specific values to guide therapy have not been established in children (Class IIb, LOE C-LD).	new for 2015
2015	Intra-arrest Care Updates	Multiple variables should be used when attempting to prognosticate outcomes during cardiac arrest (Class I, LOE C-LD).	new for 2015
2015	Intra-arrest Care Updates	For patients with invasive hemodynamic monitoring in place at the time of cardiac arrest, it may be reasonable for rescuers to use blood pressure to guide CPR quality (Class IIb, LOE C-EO).	new for 2015
2015	Intra-arrest Care Updates	It is reasonable to administer epinephrine in pediatric cardiac arrest (Class IIa, LOE C-LD).	new for 2015
2015	Intra-arrest Care Updates	For shock-refractory VF or pulseless VT, either amiodarone or lidocaine may be used (Class IIb, LOE C-LD).	new for 2015
2015	Intra-arrest Care Updates	It is reasonable to use an initial dose of 2 to 4 J/kg of monophasic or biphasic energy for defibrillation (Class IIa, LOE C-LD), but for ease of teaching, an initial dose of 2 J/kg may be considered (Class IIb, LOE C-EO).	updated for 2015
2015	Intra-arrest Care Updates	For refractory VF, it is reasonable to increase the dose to 4 J/kg (Class IIa, LOE C-LD).	updated for 2015
2015	Intra-arrest Care Updates	For subsequent energy levels, a dose of 4 J/kg may be reasonable and higher energy levels may be considered, though not to exceed 10 J/kg or the adult maximum dose (Class IIb, LOE C-LD).	updated for 2015
2015	Postarrest Care Updates	For infants and children remaining comatose after OHCA, it is reasonable either to maintain 5 days of continuous normothermia (36° to 37.5°C) or to maintain 2 days of initial continuous hypothermia (32° to 34°C) followed by 3 days of continuous normothermia (Class IIa, LOE B-R).	new for 2015
2015	Postarrest Care Updates	Continuous measurement of temperature during this time period is recommended (Class I, LOE B-NR).	new for 2015
2015	Postarrest Care Updates	Fever (temperature 38°C or higher) should be aggressively treated after ROSC (Class I, LOE B-NR).	new for 2015
2015	Postarrest Care Updates	It may be reasonable for rescuers to target normoxemia after ROSC (Class IIb, LOE B-NR).	new for 2015
2015	Postarrest Care Updates	It is reasonable for practitioners to target a Pa_{CO_2} after ROSC that is appropriate to the specific patient condition, and limit exposure to severe hypercapnia or hypocapnia (Class IIb, LOE C-LD).	new for 2015
2015	Postarrest Care Updates	After ROSC, we recommend that parenteral fluids and/or inotropes or vasoactive drugs be used to maintain a systolic blood pressure greater than fifth percentile for age (Class I, LOE C-LD).	new for 2015
2015	Postarrest Care Updates	When appropriate resources are available, continuous arterial pressure monitoring is recommended to identify and treat hypotension (Class I, LOE C-EO).	new for 2015
2015	Postarrest Care Updates	EEGs performed within the first 7 days after pediatric cardiac arrest may be considered in prognosticating neurologic outcome at the time of hospital discharge (Class IIb, LOE C-LD) but should not be used as the sole criterion.	new for 2015
2015	Postarrest Care Updates	The reliability of any one variable for prognostication in children after cardiac arrest has not been established. Practitioners should consider multiple factors when predicting outcomes in infants and children who achieve ROSC after cardiac arrest (Class I, LOE C-LD).	new for 2015
The following recommendations were not reviewed in 2015. For more information, see the *2010 AHA Guidelines for CPR and ECC*, "Part 14: Pediatric Advanced Life Support."			
2010	Family Presence During Resuscitation	Whenever possible, provide family members with the option of being present during resuscitation of an infant or child (Class I, LOE B).	not reviewed in 2015
2010	Laryngeal Mask Airway (LMA)	When bag-mask ventilation (see "Bag-Mask Ventilation," below) is unsuccessful and when endotracheal intubation is not possible, the LMA is acceptable when used by experienced providers to provide a patent airway and support ventilation (Class IIa, LOE C).	not reviewed in 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2010	Bag-Mask Ventilation	In the prehospital setting it is reasonable to ventilate and oxygenate infants and children with a bag-mask device, especially if transport time is short (Class IIa, LOE B).	not reviewed in 2015
2010	Precautions	Use only the force and tidal volume needed to just make the chest rise visibly (Class I, LOE C)	not reviewed in 2015
2010	Precautions	Avoid delivering excessive ventilation during cardiac arrest (Class III, LOE C).	not reviewed in 2015
2010	Precautions	If the infant or child is intubated, ventilate at a rate of about 1 breath every 6 to 8 seconds (8 to 10 times per minute) without interrupting chest compressions (Class I, LOE C).	not reviewed in 2015
2010	Precautions	It may be reasonable to do the same if an LMA is in place (Class IIb, LOE C).	not reviewed in 2015
2010	Precautions	In the victim with a perfusing rhythm but absent or inadequate respiratory effort, give 1 breath every 3 to 5 seconds (12 to 20 breaths per minute), using the higher rate for the younger child (Class I, LOE C).	not reviewed in 2015
2010	Two-Person Bag-Mask Ventilation	Applying cricoid pressure in an unresponsive victim to reduce air entry into the stomach (Class IIa, LOE B).	not reviewed in 2015
2010	Two-Person Bag-Mask Ventilation	Avoid excessive cricoid pressure so as not to obstruct the trachea (Class III, LOE B).	not reviewed in 2015
2010	Cricoid Pressure During Intubation	Do not continue cricoid pressure if it interferes with ventilation or the speed or ease of intubation (Class III, LOE C).	not reviewed in 2015
2010	Cuffed Versus Uncuffed Endotracheal Tubes	Both cuffed and uncuffed endotracheal tubes are acceptable for intubating infants and children (Class IIa, LOE C).	not reviewed in 2015
2010	Cuffed Versus Uncuffed Endotracheal Tubes	In certain circumstances (eg, poor lung compliance, high airway resistance, or a large glottic air leak) a cuffed endotracheal tube may be preferable to an uncuffed tube, provided that attention is paid to endotracheal tube size, position, and cuff inflation pressure (Class IIa, LOE B).	not reviewed in 2015
2010	Endotracheal Tube Size	For children between 1 and 2 years of age, it is reasonable to use a cuffed endotracheal tube with an internal diameter of 3.5 mm (Class IIa, LOE B).	not reviewed in 2015
2010	Endotracheal Tube Size	After age 2 it is reasonable to estimate tube size with the following formula (Class IIa, LOE B): Cuffed endotracheal tube ID (mm) 3.5+ (age/4).	not reviewed in 2015
2010	Esophageal Detector Device (EDD)	If capnography is not available, an esophageal detector device (EDD) may be considered to confirm endotracheal tube placement in children weighing >20 kg with a perfusing rhythm (Class IIb, LOE B), but the data are insufficient to make a recommendation for or against its use in children during cardiac arrest.	not reviewed in 2015
2010	Transtracheal Catheter Oxygenation and Ventilation	Attempt this procedure only after proper training and with appropriate equipment (Class IIb, LOE C).	not reviewed in 2015
2010	CPR Guidelines for Newborns With Cardiac Arrest of Cardiac Origin	It is reasonable to resuscitate newborns with a primary cardiac etiology of arrest, regardless of location, according to infant guidelines, with emphasis on chest compressions (Class IIa, LOE C).	not reviewed in 2015
2010	Echocardiography	When appropriately trained personnel are available, echocardiography may be considered to identify patients with potentially treatable causes of the arrest, particularly pericardial tamponade and inadequate ventricular filling (Class IIb, LOE C).	not reviewed in 2015
2010	Intraosseous (IO) Access	IO access is a rapid, safe, effective, and acceptable route for vascular access in children, and it is useful as the initial vascular access in cases of cardiac arrest (Class I, LOE C).	not reviewed in 2015
2010	Medication Dose Calculation	If the child's weight is unknown, it is reasonable to use a body length tape with precalculated doses (Class IIa, LOE C).	not reviewed in 2015
2010	Medication Dose Calculation	Regardless of the patient's habitus, use the actual body weight for calculating initial resuscitation drug doses or use a body length tape with precalculated doses (Class IIb, LOE C).	not reviewed in 2015
2010	Calcium	Calcium administration is not recommended for pediatric cardiopulmonary arrest in the absence of documented hypocalcemia, calcium channel blocker overdose, hypermagnesemia, or hyperkalemia (Class III, LOE B).	not reviewed in 2015
2010	Glucose	Check blood glucose concentration during the resuscitation and treat hypoglycemia promptly (Class I, LOE C).	not reviewed in 2015
2010	Sodium Bicarbonate	Routine administration of sodium bicarbonate is not recommended in cardiac arrest (Class III, LOE B).	not reviewed in 2015
2010	AEDs	If an AED with an attenuator is not available, use an AED with standard electrodes (Class IIa, LOE C).	not reviewed in 2015
2010	AEDs	An AED without a dose attenuator may be used if neither a manual defibrillator nor one with a dose attenuator is available (Class IIb, LOE C).	not reviewed in 2015
2010	Bradycardia	Continue to support airway, ventilation, oxygenation, and chest compressions (Class I, LOE B).	not reviewed in 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2010	Bradycardia	Emergency transcutaneous pacing may be lifesaving if the bradycardia is due to complete heart block or sinus node dysfunction unresponsive to ventilation, oxygenation, chest compressions, and medications, especially if it is associated with congenital or acquired heart disease (Class IIb, LOE C).	not reviewed in 2015
2010	Supraventricular Tachycardia	Attempt vagal stimulation first, unless the patient is hemodynamically unstable or the procedure will unduly delay chemical or electric cardioversion (Class IIa, LOE C).	not reviewed in 2015
2010	Supraventricular Tachycardia	An IV/IO dose of verapamil, 0.1 to 0.3 mg/kg is also effective in terminating SVT in older children, but it should not be used in infants without expert consultation (Class III, LOE C) because it may cause potential myocardial depression, hypotension, and cardiac arrest.	not reviewed in 2015
2010	Supraventricular Tachycardia	Use sedation, if possible. Start with a dose of 0.5 to 1 J/kg. If unsuccessful, increase the dose to 2 J/kg (Class IIb, LOE C).	not reviewed in 2015
2010	Supraventricular Tachycardia	Consider amiodarone 5 mg/kg IO/IV or procainamide 15 mg/kg IO/IV236 for a patient with SVT unresponsive to vagal maneuvers and adenosine and/or electric cardioversion; for hemodynamically stable patients, expert consultation is strongly recommended prior to administration (Class IIb, LOE C).	not reviewed in 2015
2010	Wide-Complex (>0.09 Second) Tachycardia	Consider electric cardioversion after sedation using a starting energy dose of 0.5 to 1 J/kg. If that fails, increase the dose to 2 J/kg (Class IIb, LOE C).	not reviewed in 2015
2010	Wide-Complex (>0.09 Second) Tachycardia	Electric cardioversion is recommended using a starting energy dose of 0.5 to 1 J/kg. If that fails, increase the dose to 2 J/kg (Class I, LOE C).	not reviewed in 2015
2010	Septic Shock	Early assisted ventilation may be considered as part of a protocol-driven strategy for septic shock (Class IIb, LOE C).	not reviewed in 2015
2010	Septic Shock	Etomidate has been shown to facilitate endotracheal intubation in infants and children with minimal hemodynamic effect, but do not use it routinely in pediatric patients with evidence of septic shock (Class III, LOE B).	not reviewed in 2015
2010	Trauma	Do not routinely hyperventilate even in case of head injury (Class III, LOE C).	not reviewed in 2015
2010	Trauma	If the patient has maxillofacial trauma or if you suspect a basilar skull fracture, insert an orogastric rather than a nasogastric tube (Class IIa, LOE C).	not reviewed in 2015
2010	Trauma	In the very select circumstances of children with cardiac arrest from penetrating trauma with short transport times, consider performing resuscitative thoracotomy (Class IIb, LOE C).	not reviewed in 2015
2010	Single Ventricle	Neonates in a prearrest state due to elevated pulmonary-to-systemic flow ratio prior to Stage I repair might benefit from a Pa_{CO_2} of 50 to 60 mm Hg, which can be achieved during mechanical ventilation by reducing minute ventilation, increasing the inspired fraction of CO_2, or administering opioids with or without chemical paralysis (Class IIb, LOE B).	not reviewed in 2015
2010	Single Ventricle	Neonates in a low cardiac output state following stage I repair may benefit from systemic vasodilators such as α-adrenergic antagonists (eg, phenoxybenzamine) to treat or ameliorate increased systemic vascular resistance, improve systemic oxygen delivery, and reduce the likelihood of cardiac arrest (Class IIa, LOE B).	not reviewed in 2015
2010	Single Ventricle	Other drugs that reduce systemic vascular resistance (eg, milrinone or nipride) may also be considered for patients with excessive Qp:Qs (Class IIa, LOE B).	not reviewed in 2015
2010	Single Ventricle	During cardiopulmonary arrest, it is reasonable to consider extracorporeal membrane oxygenation (ECMO) for patients with single ventricle anatomy who have undergone Stage I procedure (Class IIa, LOE B).	not reviewed in 2015
2010	Single Ventricle	Hypoventilation may improve oxygen delivery in patients in a prearrest state with Fontan or hemi-Fontan/bidirectional Glenn (BDG) physiology (Class IIa, LOE B).	not reviewed in 2015
2010	Single Ventricle	Negative pressure ventilation may improve cardiac output (Class IIa, LOE C).	not reviewed in 2015
2010	Single Ventricle	During cardiopulmonary arrest, it is reasonable to consider extracorporeal membrane oxygenation (ECMO) for patients with Fontan physiology (Class IIa, LOE C).	not reviewed in 2015
2010	Pulmonary Hypertension	If intravenous or inhaled therapy to decrease pulmonary hypertension has been interrupted, reinstitute it (Class IIa, LOE C).	not reviewed in 2015
2010	Pulmonary Hypertension	Consider administering inhaled nitric oxide (iNO) or aerosolized prostacyclin or analogue to reduce pulmonary vascular resistance (Class IIa, LOE C).	not reviewed in 2015
2010	Pulmonary Hypertension	If iNO is not available, consider giving an intravenous bolus of prostacyclin (Class IIa, LOE C).	not reviewed in 2015
2010	Pulmonary Hypertension	ECMO may be beneficial if instituted early in the resuscitation (Class IIa, LOE C).	not reviewed in 2015
2010	Cocaine	For coronary vasospasm consider nitroglycerin (Class IIa, LOE C), a benzodiazepine, and phentolamine (an α-adrenergic antagonist) (Class IIb, LOE C).	not reviewed in 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2010	Cocaine	Do not give α-adrenergic blockers (Class III, LOE C).	not reviewed in 2015
2010	Cocaine	For ventricular arrhythmia, consider sodium bicarbonate (1 to 2 mEq/kg) administration (Class IIb, LOE C) in addition to standard treatment.	not reviewed in 2015
2010	Cocaine	To prevent arrhythmias secondary to myocardial infarction, consider a lidocaine bolus followed by a lidocaine infusion (Class IIb, LOE C).	not reviewed in 2015
2010	Tricyclic Antidepressants and Other Sodium Channel Blockers	Do not administer Class IA (quinidine, procainamide), Class IC (flecainide, propafenone), or Class III (amiodarone and sotalol) antiarrhythmics, which may exacerbate cardiac toxicity (Class III, LOE C).	not reviewed in 2015
2010	Calcium Channel Blockers	The effectiveness of calcium administration is variable (Class IIb, LOE C).	not reviewed in 2015
2010	Calcium Channel Blockers	For bradycardia and hypotension, consider vasopressors and inotropes such as norepinephrine or epinephrine (Class IIb, LOE C)	not reviewed in 2015
2010	Beta-Adrenergic Blockers	High-dose epinephrine infusion may be effective (Class IIb, LOE C).	not reviewed in 2015
2010	Beta-Adrenergic Blockers	Consider glucagon (Class IIb, LOE C).	not reviewed in 2015
2010	Beta-Adrenergic Blockers	Consider an infusion of glucose and insulin (Class IIb, LOE C).	not reviewed in 2015
2010	Beta-Adrenergic Blockers	There are insufficient data to make a recommendation for or against using calcium (Class IIb, LOE C).	not reviewed in 2015
2010	Beta-Adrenergic Blockers	Calcium may be considered if glucagon and catecholamines are ineffective (Class IIb, LOE C).	not reviewed in 2015
2010	Opioids	Support of oxygenation and ventilation is the initial treatment for severe respiratory depression from any cause (Class I).	not reviewed in 2015
2010	Opioids	Naloxone reverses the respiratory depression of narcotic overdose (Class I, LOE B).	not reviewed in 2015
2010	Respiratory System	Monitor exhaled CO_2 (P_{ETCO_2}), especially during transport and diagnostic procedures (Class IIa, LOE B).	not reviewed in 2015
2010	Dopamine	Titrate dopamine to treat shock that is unresponsive to fluids and when systemic vascular resistance is low (Class IIb, LOE C).	not reviewed in 2015
2010	Inodilators	It is reasonable to use an inodilator in a highly monitored setting for treatment of myocardial dysfunction with increased systemic or pulmonary vascular resistance (Class IIa, LOE B).	not reviewed in 2015
2010	Neurologic System	It is reasonable for adolescents resuscitated from sudden, witnessed, out-of-hospital VF cardiac arrest (Class IIa, LOE C).	not reviewed in 2015
2010	Neurologic System	Monitor temperature continuously, if possible, and treat fever (>38°C) aggressively with antipyretics and cooling devices because fever adversely influences recovery from ischemic brain injury (Class IIa, LOE C).	not reviewed in 2015
2010	Interhospital Transport	Monitor exhaled CO_2 (qualitative colorimetric detector or capnography) during interhospital or intrahospital transport of intubated patients (Class IIa, LOE B).	not reviewed in 2015
2010	Family Presence During Resuscitation	Whenever possible, provide family members with the option of being present during resuscitation of an infant or child (Class I, LOE B).	not reviewed in 2015
2010	Family Presence During Resuscitation	If the presence of family members creates undue staff stress or is considered detrimental to the resuscitation, then family members should be respectfully asked to leave (Class IIa, LOE C).	not reviewed in 2015
2010	Sudden Unexplained Deaths	Refer families of patients that do not have a cause of death found on autopsy to a healthcare provider or center with expertise in arrhythmias (Class I, LOE C).	not reviewed in 2015
Part 13: Neonatal Resuscitation			
2015	Umbilical Cord Management	In summary, from the evidence reviewed in the 2010 CoSTR and subsequent review of DCC and cord milking in preterm newborns in the 2015 ILCOR systematic review, DCC for longer than 30 seconds is reasonable for both term and preterm infants who do not require resuscitation at birth (Class IIa, LOE C-LD).	new for 2015
2015	Umbilical Cord Management	There is insufficient evidence to recommend an approach to cord clamping for infants who require resuscitation at birth and more randomized trials involving such infants are encouraged. In light of the limited information regarding the safety of rapid changes in blood volume for extremely preterm infants, we suggest against the routine use of cord milking for infants born at less than 29 weeks of gestation outside of a research setting. Further study is warranted because cord milking may improve initial mean blood pressure, hematologic indices, and reduce intracranial hemorrhage, but thus far there is no evidence for improvement in long-term outcomes (Class IIb, LOE C-LD).	new for 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2015	Importance of Maintaining Normal Temperature in the Delivery Room	Preterm infants are especially vulnerable. Hypothermia is also associated with serious morbidities, such as increased respiratory issues, hypoglycemia, and late-onset sepsis. Because of this, admission temperature should be recorded as a predictor of outcomes as well as a quality indicator (Class I, LOE B-NR).	new for 2015
2015	Importance of Maintaining Normal Temperature in the Delivery Room	It is recommended that the temperature of newly born nonasphyxiated infants be maintained between 36.5°C and 37.5°C after birth through admission and stabilization (Class I, LOE C-LD).	new for 2015
2015	Interventions to Maintain Newborn Temperature in the Delivery Room	The use of radiant warmers and plastic wrap with a cap has improved but not eliminated the risk of hypothermia in preterms in the delivery room. Other strategies have been introduced, which include increased room temperature, thermal mattresses, and the use of warmed humidified resuscitation gases. Various combinations of these strategies may be reasonable to prevent hypothermia in infants born at less than 32 weeks of gestation (Class IIb, LOE B-R, B-NR, C-LD).	updated for 2015
2015	Interventions to Maintain Newborn Temperature in the Delivery Room	Compared with plastic wrap and radiant warmer, the addition of a thermal mattress, warmed humidified gases and increased room temperature plus cap plus thermal mattress were all effective in reducing hypothermia. For all the studies, hyperthermia was a concern, but harm was not shown. Hyperthermia (greater than 38.0°C) should be avoided due to the potential associated risks (Class III: Harm, LOE C-EO).	updated for 2015
2015	Warming Hypothermic Newborns to Restore Normal Temperature	The traditional recommendation for the method of rewarming neonates who are hypothermic after resuscitation has been that slower is preferable to faster rewarming to avoid complications such as apnea and arrhythmias. However, there is insufficient current evidence to recommend a preference for either rapid (0.5°C/h or greater) or slow rewarming (less than 0.5°C/h) of unintentionally hypothermic newborns (T° less than 36°C) at hospital admission. Either approach to rewarming may be reasonable (Class IIb, LOE C-LD).	new for 2015
2015	Maintaining Normothermia in Resource-Limited Settings	In resource-limited settings, to maintain body temperature or prevent hypothermia during transition (birth until 1 to 2 hours of life) in well newborn infants, it may be reasonable to put them in a clean food-grade plastic bag up to the level of the neck and swaddle them after drying (Class IIb, LOE C-LD).	new for 2015
2015	Maintaining Normothermia in Resource-Limited Settings	Another option that may be reasonable is to nurse such newborns with skin-to-skin contact or kangaroo mother care (Class IIb, LOE C-LD).	new for 2015
2015	Clearing the Airway When Meconium Is Present	However, if the infant born through meconium-stained amniotic fluid presents with poor muscle tone and inadequate breathing efforts, the initial steps of resuscitation should be completed under the radiant warmer. PPV should be initiated if the infant is not breathing or the heart rate is less than 100/min after the initial steps are completed. Routine intubation for tracheal suction in this setting is not suggested, because there is insufficient evidence to continue recommending this practice (Class IIb, LOE C-LD).	updated for 2015
2015	Assessment of Heart Rate	During resuscitation of term and preterm newborns, the use of 3-lead ECG for the rapid and accurate measurement of the newborn's heart rate may be reasonable (Class IIb, LOE C-LD).	new for 2015
2015	Administration of Oxygen in Preterm Infants	In all studies, irrespective of whether air or high oxygen (including 100%) was used to initiate resuscitation, most infants were in approximately 30% oxygen by the time of stabilization. Resuscitation of preterm newborns of less than 35 weeks of gestation should be initiated with low oxygen (21% to 30%), and the oxygen concentration should be titrated to achieve preductal oxygen saturation approximating the interquartile range measured in healthy term infants after vaginal birth at sea level (Class I, LOE B-R).	new for 2015
2015	Administration of Oxygen	Initiating resuscitation of preterm newborns with high oxygen (65% or greater) is not recommended (Class III: No Benefit, LOE B-R).	new for 2015
2015	Positive Pressure Ventilation (PPV)	There is insufficient data regarding short and long-term safety and the most appropriate duration and pressure of inflation to support routine application of sustained inflation of greater than 5 seconds' duration to the transitioning newborn (Class IIb, LOE B-R).	new for 2015
2015	Positive Pressure Ventilation (PPV)	In 2015, the Neonatal Resuscitation ILCOR and Guidelines Task Forces repeated their 2010 recommendation that, when PPV is administered to preterm newborns, approximately 5 cm H_2O PEEP is suggested (Class IIb, LOE B-R).	updated for 2015
2015	Positive Pressure Ventilation (PPV)	PPV can be delivered effectively with a flow-inflating bag, self-inflating bag, or T-piece resuscitator (Class IIa, LOE B-R).	updated for 2015
2015	Positive Pressure Ventilation (PPV)	Use of respiratory mechanics monitors have been reported to prevent excessive pressures and tidal volumes and exhaled CO_2 monitors may help assess that actual gas exchange is occurring during face-mask PPV attempts. Although use of such devices is feasible, thus far their effectiveness, particularly in changing important outcomes, has not been established (Class IIb, LOE C-LD).	new for 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2015	Positive Pressure Ventilation (PPV)	Laryngeal masks, which fit over the laryngeal inlet, can achieve effective ventilation in term and preterm newborns at 34 weeks or more of gestation. Data are limited for their use in preterm infants delivered at less than 34 weeks of gestation or who weigh less than 2000 g. A laryngeal mask may be considered as an alternative to tracheal intubation if face-mask ventilation is unsuccessful in achieving effective ventilation (Class IIb, LOE B-R).	updated for 2015
2015	Positive Pressure Ventilation (PPV)	A laryngeal mask is recommended during resuscitation of term and preterm newborns at 34 weeks or more of gestation when tracheal intubation is unsuccessful or is not feasible (Class I, LOE C-EO).	updated for 2015
2015	CPAP	Based on this evidence, spontaneously breathing preterm infants with respiratory distress may be supported with CPAP initially rather than routine intubation for administering PPV (Class IIb, LOE B-R).	updated for 2015
2015	Chest Compressions	Compressions are delivered on the lower third of the sternum to a depth of approximately one third of the anterior-posterior diameter of the chest (Class IIb, LOE C-LD).	updated for 2015
2015	Chest Compressions	Because the 2-thumb technique generates higher blood pressures and coronary perfusion pressure with less rescuer fatigue, the 2 thumb–encircling hands technique is suggested as the preferred method (Class IIb, LOE C-LD).	updated for 2015
2015	Chest Compressions	It is still suggested that compressions and ventilations be coordinated to avoid simultaneous delivery. The chest should be allowed to re-expand fully during relaxation, but the rescuer's thumbs should not leave the chest. The Neonatal Resuscitation ILCOR and Guidelines Task Forces continue to support use of a 3:1 ratio of compressions to ventilation, with 90 compressions and 30 breaths to achieve approximately 120 events per minute to maximize ventilation at an achievable rate (Class IIa, LOE C-LD).	updated for 2015
2015	Chest Compressions	A 3:1 compression-to-ventilation ratio is used for neonatal resuscitation where compromise of gas exchange is nearly always the primary cause of cardiovascular collapse, but rescuers may consider using higher ratios (eg, 15:2) if the arrest is believed to be of cardiac origin (Class IIb, LOE C-EO).	updated for 2015
2015	Chest Compressions	The Neonatal Guidelines Writing Group endorses increasing the oxygen concentration to 100% whenever chest compressions are provided (Class IIa, LOE C-EO).	new for 2015
2015	Chest Compressions	To reduce the risks of complications associated with hyperoxia the supplementary oxygen concentration should be weaned as soon as the heart rate recovers (Class I, LOE C-LD).	new for 2015
2015	Chest Compressions	The current measure for determining successful progress in neonatal resuscitation is to assess the heart rate response. Other devices, such as end-tidal CO_2 monitoring and pulse oximetry, may be useful techniques to determine when return of spontaneous circulation occurs. However, in asystolic/bradycardic neonates, we suggest against the routine use of any single feedback device such as $ETCO_2$ monitors or pulse oximeters for detection of return of spontaneous circulation as their usefulness for this purpose in neonates has not been well established (Class IIb, LOE C-LD).	new for 2015
2015	Induced Therapeutic Hypothermia Resource-Limited Areas	Evidence suggests that use of therapeutic hypothermia in resource-limited settings (ie, lack of qualified staff, inadequate equipment, etc) may be considered and offered under clearly defined protocols similar to those used in published clinical trials and in facilities with the capabilities for multidisciplinary care and longitudinal follow-up (Class IIb, LOE-B-R).	new for 2015
2015	Guidelines for Withholding and Discontinuing	However, in individual cases, when counseling a family and constructing a prognosis for survival at gestations below 25 weeks, it is reasonable to consider variables such as perceived accuracy of gestational age assignment, the presence or absence of chorioamnionitis, and the level of care available for location of delivery. It is also recognized that decisions about appropriateness of resuscitation below 25 weeks of gestation will be influenced by region-specific guidelines. In making this statement, a higher value was placed on the lack of evidence for a generalized prospective approach to changing important outcomes over improved retrospective accuracy and locally validated counseling policies. The most useful data for antenatal counseling provides outcome figures for infants alive at the onset of labor, not only for those born alive or admitted to a neonatal intensive care unit (Class IIb, LOE C-LD).	new for 2015
2015	Guidelines for Withholding and Discontinuing	We suggest that, in infants with an Apgar score of 0 after 10 minutes of resuscitation, if the heart rate remains undetectable, it may be reasonable to stop assisted ventilations; however, the decision to continue or discontinue resuscitative efforts must be individualized. Variables to be considered may include whether the resuscitation was considered optimal; availability of advanced neonatal care, such as therapeutic hypothermia; specific circumstances before delivery (eg, known timing of the insult); and wishes expressed by the family (Class IIb, LOE C-LD).	updated for 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2015	Structure of Educational Programs to Teach Neonatal Resuscitation: Instructors	Until more research is available to clarify the optimal instructor training methodology, it is suggested that neonatal resuscitation instructors be trained using timely, objective, structured, and individually targeted verbal and/or written feedback (Class IIb, LOE C-EO).	new for 2015
2015	Structure of Educational Programs to Teach Neonatal Resuscitation: Providers	Studies that explored how frequently healthcare providers or healthcare students should train showed no differences in patient outcomes (LOE C-EO) but were able to show some advantages in psychomotor performance (LOE B-R) and knowledge and confidence (LOE C-LD) when focused training occurred every 6 months or more frequently. It is therefore suggested that neonatal resuscitation task training occur more frequently than the current 2-year interval (Class IIb, LOE B-R, LOE C-EO, LOE C-LD).	new for 2015
The following recommendations were not reviewed in 2015. For more information, see the *2010 AHA Guidelines for CPR and ECC*, "Part 15: Neonatal Resuscitation."			
2010	Temperature Control	All resuscitation procedures, including endotracheal intubation, chest compression, and insertion of intravenous lines, can be performed with these temperature-controlling interventions in place (Class IIb, LOE C).	not reviewed in 2015
2010	Clearing the Airway When Amniotic Fluid Is Clear	Suctioning immediately after birth, whether with a bulb syringe or suction catheter, may be considered only if the airway appears obstructed or if PPV is required (Class IIb, LOE C).	not reviewed in 2015
2010	Assessment of Oxygen Need and Administration of Oxygen	It is recommended that oximetry be used when resuscitation can be anticipated, when PPV is administered, when central cyanosis persists beyond the first 5 to 10 minutes of life, or when supplementary oxygen is administered (Class I, LOE B).	not reviewed in 2015
2010	Administration of Oxygen in Term Infants	It is reasonable to initiate resuscitation with air (21% oxygen at sea level; Class IIb, LOE C).	not reviewed in 2015
2010	Administration of Oxygen in Term Infants	Supplementary oxygen may be administered and titrated to achieve a preductal oxygen saturation approximating the interquartile range measured in healthy term infants after vaginal birth at sea level (Class IIb, LOE B).	not reviewed in 2015
2010	Initial Breaths and Assisted Ventilation	Inflation pressure should be monitored; an initial inflation pressure of 20 cm H_2O may be effective, but ≥30 to 40 cm H_2O may be required in some term babies without spontaneous ventilation (Class IIb, LOE C).	not reviewed in 2015
2010	Initial Breaths and Assisted Ventilation	In summary, assisted ventilation should be delivered at a rate of 40 to 60 breaths per minute to promptly achieve or maintain a heart rate 100 per minute (Class IIb, LOE C).	not reviewed in 2015
2010	Assisted-Ventilation Devices	Target inflation pressures and long inspiratory times are more consistently achieved in mechanical models when T-piece devices are used rather than bags, although the clinical implications of these findings are not clear (Class IIb, LOE C).	not reviewed in 2015
2010	Assisted-Ventilation Devices	Resuscitators are insensitive to changes in lung compliance, regardless of the device being used (Class IIb, LOE C).	not reviewed in 2015
2010	Endotracheal Tube Placement	Although last reviewed in 2010, exhaled CO_2 detection remains the most reliable method of confirmation of endotracheal tube placement (Class IIa, LOE B).	not reviewed in 2015
2010	Chest Compressions	Respirations, heart rate, and oxygenation should be reassessed periodically, and coordinated chest compressions and ventilations should continue until the spontaneous heart rate is 60 per minute (Class IIb, LOE C).	not reviewed in 2015
2010	Epinephrine	Dosing recommendations remain unchanged from 2010. Intravenous administration of epinephrine may be considered at a dose of 0.01 to 0.03 mg/kg of 1:10 000 epinephrine. If an endotracheal administration route is attempted while intravenous access is being established, higher dosing will be needed at 0.05 to 0.1 mg/kg. (Class IIb, LOE C).	not reviewed in 2015
2010	Epinephrine	Given the lack of supportive data for endotracheal epinephrine, it is reasonable to provide drugs by the intravenous route as soon as venous access is established (Class IIb, LOE C).	not reviewed in 2015
2010	Volume Expansion	Volume expansion may be considered when blood loss is known or suspected (pale skin, poor perfusion, weak pulse) and the infant's heart rate has not responded adequately to other resuscitative measures (Class IIb, LOE C).	not reviewed in 2015
2010	Volume Expansion	An isotonic crystalloid solution or blood may be useful for volume expansion in the delivery room (Class IIb, LOE C).	not reviewed in 2015
2010	Volume Expansion	The recommended dose is 10 mL/kg, which may need to be repeated. When resuscitating premature infants, care should be taken to avoid giving volume expanders rapidly, because rapid infusions of large volumes have been associated with IVH (Class IIb, LOE C).	not reviewed in 2015
2010	Induced Therapeutic Hypothermia Resource-Abundant Areas	Induced therapeutic hypothermia was last reviewed in 2010; at that time it was recommended that infants born at more than 36 weeks of gestation with evolving moderate-to-severe hypoxic-ischemic encephalopathy should be offered therapeutic hypothermia under clearly defined protocols similar to those used in published clinical trials and in facilities with the capabilities for multidisciplinary care and longitudinal follow-up (Class IIa, LOE A).	not reviewed in 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2010	Guidelines for Withholding and Discontinuing	The 2010 Guidelines provide suggestions for when resuscitation is not indicated, when it is nearly always indicated, and that under circumstances when outcome remains unclear, that the desires of the parents should be supported (Class IIb, LOE C).	not reviewed in 2015
2010	Briefing/Debriefing	It is still suggested that briefing and debriefing techniques be used whenever possible for neonatal resuscitation (Class IIb, LOE C).	not reviewed in 2015
Part 14: Education			
2015	Basic Life Support Training	CPR self-instruction through video- and/or computer-based modules paired with hands-on practice may be a reasonable alternative to instructor-led courses (Class IIb, LOE C-LD).	updated for 2015
2015	Basic Life Support Training	A combination of self-instruction and instructor-led teaching with hands-on training can be considered as an alternative to traditional instructor-led courses for lay providers. If instructor-led training is not available, self-directed training may be considered for lay providers learning AED skills (Class IIb, LOE C-EO).	new for 2015
2015	Basic Life Support Training	Self-directed methods can be considered for healthcare professionals learning AED skills (Class IIb, LOE C-EO).	new for 2015
2015	Basic Life Support Training	Use of feedback devices can be effective in improving CPR performance during training (Class IIa, LOE A).	updated for 2015
2015	Basic Life Support Training	If feedback devices are not available, auditory guidance (eg, metronome, music) may be considered to improve adherence to recommendations for chest compression rate only (Class IIb, LOE B-R).	updated for 2015
2015	Basic Life Support Training	Given the rapidity with which BLS skills decay after training, coupled with the observed improvement in skill and confidence among students who train more frequently, it may be reasonable for BLS retraining to be completed more often by individuals who are likely to encounter cardiac arrest (Class IIb, LOE C-LD).	updated for 2015
2015	Advanced Life Support Training	Precourse preparation, including review of appropriate content information, online/precourse testing, and practice of pertinent technical skills are reasonable before attending ALS training programs (Class IIa, LOE C-EO).	updated for 2015
2015	Advanced Life Support Training	Given very small risk for harm and the potential benefit of team and leadership training, the inclusion of team and leadership training as part of ALS training is reasonable (Class IIa, LOE C-LD).	updated for 2015
2015	Advanced Life Support Training	The use of high-fidelity manikins for ALS training can be beneficial for improving skills performance at course conclusion (Class IIa, LOE B-R).	updated for 2015
2015	Advanced Life Support Training	Given the potential educational benefits of short, frequent retraining sessions coupled with the potential for cost savings from reduced training time and removal of staff from the clinical environment for standard refresher training, it is reasonable that individuals who are likely to encounter a cardiac arrest victim perform more frequent manikin-based retraining (Class IIa, LOE C-LD)	updated for 2015
2015	Special Considerations	Communities may consider training bystanders in compression-only CPR for adult out-of-hospital cardiac arrest as an alternative to training in conventional CPR (Class IIb, LOE C-LD).	new for 2015
2015	Special Considerations	It may be reasonable to use alternative instructional modalities for BLS and/or ALS teaching in resource-limited environments (Class IIb, LOE C-LD).	new for 2015
2015	Special Considerations	Training primary caregivers and/or family members of high-risk patients may be reasonable (Class IIb, LOE C-LD), although further work needs to help define which groups to preferentially target.	new for 2015
The following recommendations were not reviewed in 2015. For more information, see the *2010 AHA Guidelines for CPR and ECC*, "Part 16: Education, Implementation, and Teams."			
2010	Barriers to Recognition of Cardiac Arrest	Rescuers should be taught to initiate CPR if the adult victim is unresponsive and is not breathing or not breathing normally (eg, only gasping) (Class I, LOE B).	not reviewed in 2015
2010	Physical and Psychological Concerns for Rescuers	It is reasonable that participants undertaking CPR training be advised of the vigorous physical activity required during the skills portion of the training program (Class IIa, LOE B).	not reviewed in 2015
2010	Barriers to AED Use	To maximize willingness to use an AED, public access defibrillation training should continue to be encouraged for the lay public (Class I, LOE B).	not reviewed in 2015
2010	Course Design	Consistent with established methodologies for program evaluation, the effectiveness of resuscitation courses should be evaluated (Class I, LOE C).	not reviewed in 2015
2010	AED Training Requirement	Allowing the use of AEDs by untrained bystanders can be beneficial and may be lifesaving (Class IIa, LOE B).	not reviewed in 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2010	AED Training Requirement	Because even minimal training has been shown to improve performance in simulated cardiac arrests, training opportunities should be made available and promoted for the lay rescuer (Class I, LOE B).	not reviewed in 2015
2010	Course Delivery Formats	It is reasonable to consider alternative course scheduling formats for advanced life support courses (eg, ACLS or PALS), provided acceptable programmatic evaluation is conducted and learners meet course objectives (Class IIa, LOE B).	not reviewed in 2015
2010	Checklists/Cognitive Aids	Checklists or cognitive aids, such as the AHA algorithms, may be considered for use during actual resuscitation (Class IIb, LOE C).	not reviewed in 2015
2010	Debriefing	Debriefing as a technique to facilitate learning should be included in all advanced life support courses (Class I, LOE B).	not reviewed in 2015
2010	Regional Systems of (Emergency) Cardiovascular Care	It is reasonable that regional systems of care be considered as part of an overall approach to improve survival from cardiac arrest (Class IIa, LOE C).	not reviewed in 2015
2010	Barriers to Bystander CPR	Because panic can significantly impair a bystander's ability to perform in an emergency, it may be reasonable for CPR training to address the possibility of panic and encourage learners to consider how they will overcome it (Class IIb LOE C).	not reviewed in 2015
2010	Barriers to Bystander CPR	Despite the low risk of infections, it is reasonable to teach rescuers about the use of barrier devices emphasizing that CPR should not be delayed for their use (Class IIa, LOE C).	not reviewed in 2015
2010	Post-Course Assessment	A written test should not be used exclusively to assess learner competence following an advanced life support course (Class I, LOE B).	not reviewed in 2015
2010	Post-Course Assessment	End-of-course assessment may be useful in helping learners retain skills (Class IIb, LOE C).	not reviewed in 2015
2010	Training Intervals	Skill performance should be assessed during the 2-year certification with reinforcement provided as needed (Class I, LOE B).	not reviewed in 2015
Part 15: First Aid			
2015	First Aid Education	Education and training in first aid can be useful to decrease morbidity and mortality from injury and illness (Class IIa, LOE C-LD).	new for 2015
2015	First Aid Education	We recommend that first aid education be universally available (Class I, LOE C-EO).	new for 2015
2015	Positioning the Ill or Injured Person	If the area is unsafe for the first aid provider or the person, move to a safe location if possible (Class I, LOE C-EO).	updated for 2015
2015	Positioning the Ill or Injured Person	If a person is unresponsive and breathing normally, it may be reasonable to place him or her in a lateral side-lying recovery position (Class IIb, LOE C-LD).	updated for 2015
2015	Positioning the Ill or Injured Person	If a person has been injured and the nature of the injury suggests a neck, back, hip, or pelvic injury, the person should not be rolled onto his or her side and instead should be left in the position in which they were found, to avoid potential further injury (Class I, LOE C-EO).	updated for 2015
2015	Positioning the Ill or Injured Person	If leaving the person in the position found is causing the person's airway to be blocked, or if the area is unsafe, move the person only as needed to open the airway and to reach a safe location (Class I, LOE C-EO).	updated for 2015
2015	Position for Shock	If a person shows evidence of shock and is responsive and breathing normally, it is reasonable to place or maintain the person in a supine position (Class IIa, LOE C-LD).	updated for 2015
2015	Position for Shock	If there is no evidence of trauma or injury (eg, simple fainting, shock from nontraumatic bleeding, sepsis, dehydration), raising the feet about 6 to 12 inches (about 30° to 60°) from the supine position is an option that may be considered while awaiting arrival of EMS (Class IIb, LOE C-LD).	updated for 2015
2015	Position for Shock	Do not raise the feet of a person in shock if the movement or the position causes pain (Class III: Harm, LOE C-EO).	new for 2015
2015	Oxygen Use in First Aid	The use of supplementary oxygen by first aid providers with specific training is reasonable for cases of decompression sickness (Class IIa, LOE C-LD).	updated for 2015
2015	Oxygen Use in First Aid	For first aid providers with specific training in the use of oxygen, the administration of supplementary oxygen to persons with known advanced cancer with dyspnea and hypoxemia may be reasonable (Class IIb, LOE B-R).	new for 2015
2015	Oxygen Use in First Aid	Although no evidence was identified to support the use of oxygen, it might be reasonable to provide oxygen to spontaneously breathing persons who are exposed to carbon monoxide while waiting for advanced medical care (Class IIb, LOE C-EO).	new for 2015
2015	Medical Emergencies: Asthma	It is reasonable for first aid providers to be familiar with the available inhaled bronchodilator devices and to assist as needed with the administration of prescribed bronchodilators when a person with asthma is having difficulty breathing (Class IIa, LOE B-R).	updated for 2015
2015	Medical Emergencies: Stroke	The use of a stroke assessment system by first aid providers is recommended (Class I, LOE B-NR).	new for 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2015	Medical Emergencies: Chest Pain	Aspirin has been found to significantly decrease mortality due to myocardial infarction in several large studies and is therefore recommended for persons with chest pain due to suspected myocardial infarction (Class I, LOE B-R).	updated for 2015
2015	Medical Emergencies: Chest Pain	Call EMS immediately for anyone with chest pain or other signs of heart attack, rather than trying to transport the person to a healthcare facility yourself (Class I, LOE C-EO).	new for 2015
2015	Medical Emergencies: Chest Pain	While waiting for EMS to arrive, the first aid provider may encourage a person with chest pain to take aspirin if the signs and symptoms suggest that the person is having a heart attack and the person has no allergy or contraindication to aspirin, such as recent bleeding (Class IIa, LOE B-NR).	updated for 2015
2015	Medical Emergencies: Chest Pain	If a person has chest pain that does not suggest that the cause is cardiac in origin, or if the first aid provider is uncertain or uncomfortable with administration of aspirin, then the first aid provider should not encourage the person to take aspirin (Class III: Harm, LOE C-EO).	new for 2015
2015	Medical Emergencies: Anaphylaxis	The recommended dose of epinephrine is 0.3 mg intramuscularly for adults and children greater than 30 kg, 0.15 mg intramuscularly for children 15 to 30 kg, or as prescribed by the person's physician. First aid providers should call 9-1-1 immediately when caring for a person with suspected anaphylaxis or a severe allergic reaction (Class I, LOE C-EO).	new for 2015
2015	Medical Emergencies: Anaphylaxis	When a person with anaphylaxis does not respond to the initial dose, and arrival of advanced care will exceed 5 to 10 minutes, a repeat dose may be considered (Class IIb, LOE C-LD).	updated for 2015
2015	Medical Emergencies: Hypoglycemia	If the person is unconscious, exhibits seizures, or is unable to follow simple commands or swallow safely, the first aid provider should call for EMS immediately (Class I, LOE C-EO).	new for 2015
2015	Medical Emergencies: Hypoglycemia	If a person with diabetes reports low blood sugar or exhibits signs or symptoms of mild hypoglycemia and is able to follow simple commands and swallow, oral glucose should be given to attempt to resolve the hypoglycemia. Glucose tablets, if available, should be used to reverse hypoglycemia in a person who is able to take these orally (Class I, LOE B-R).	new for 2015
2015	Medical Emergencies: Hypoglycemia	It is reasonable to use these dietary sugars as an alternative to glucose tablets (when not available) for reversal of mild symptomatic hypoglycemia (Class IIa, LOE B-R).	new for 2015
2015	Medical Emergencies: Hypoglycemia	First aid providers should therefore wait at least 10 to 15 minutes before calling EMS and re-treating a diabetic with mild symptomatic hypoglycemia with additional oral sugars (Class I, LOE B-R).	new for 2015
2015	Medical Emergencies: Hypoglycemia	If the person's status deteriorates during that time or does not improve, the first aid provider should call EMS (Class I, LOE C-EO).	new for 2015
2015	Medical Emergencies: Dehydration	In the absence of shock, confusion, or inability to swallow, it is reasonable for first aid providers to assist or encourage individuals with exertional dehydration to orally rehydrate with CE drinks (Class IIa, LOE B-R)	new for 2015
2015	Medical Emergencies: Dehydration	If these alternative beverages are not available, potable water may be used (Class IIb, LOE B-R).	new for 2015
2015	Medical Emergencies: Toxic Eye Injury	It can be beneficial to rinse eyes exposed to toxic chemicals immediately and with a copious amount of tap water for at least 15 minutes or until advanced medical care arrives (Class IIa, LOE C-LD).	updated for 2015
2015	Medical Emergencies: Toxic Eye Injury	If tap water is not available, normal saline or another commercially available eye irrigation solution may be reasonable (Class IIb, LOE C-LD).	new for 2015
2015	Medical Emergencies: Chemical Eye Injury	First aid providers caring for individuals with chemical eye injury should contact their local poison control center or, if a poison control center is not available, seek help from a medical provider or 9-1-1 (Class I, LOE C-EO).	new for 2015
2015	Trauma Emergencies: Control of Bleeding	There continues to be no evidence to support the use of pressure points or elevation of an injury to control external bleeding. The use of pressure points or elevation of an extremity to control external bleeding is not indicated (Class III: No Benefit, LOE C-EO).	updated for 2015
2015	Trauma Emergencies: Control of Bleeding	The standard method for first aid providers to control open bleeding is to apply direct pressure to the bleeding site until it stops. Control open bleeding by applying direct pressure to the bleeding site (Class I, LOE B-NR).	updated for 2015
2015	Trauma Emergencies: Control of Bleeding	Local cold therapy, such as an instant cold pack, can be useful for these types of injuries to the extremity or scalp (Class IIa, LOE C-LD).	new for 2015
2015	Trauma Emergencies: Control of Bleeding	Cold therapy should be used with caution in children because of the risk of hypothermia in this population (Class I, LOE C-EO).	new for 2015
2015	Trauma Emergencies: Control of Bleeding	Because the rate of complications is low and the rate of hemostasis is high, first aid providers may consider the use of a tourniquet when standard first aid hemorrhage control does not control severe external limb bleeding (Class IIb, LOE C-LD).	updated for 2015

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2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2015	Trauma Emergencies: Control of Bleeding	A tourniquet may be considered for initial care when a first aid provider is unable to use standard first aid hemorrhage control, such as during a mass casualty incident, with a person who has multisystem trauma, in an unsafe environment, or with a wound that cannot be accessed (Class IIb, LOE C-EO).	new for 2015
2015	Trauma Emergencies: Control of Bleeding	Although maximum time for tourniquet use was not reviewed by a 2015 ILCOR systematic review, it has been recommended that the first aid provider note the time that a tourniquet is first applied and communicate this information with EMS providers. It is reasonable for first aid providers to be trained in the proper application of tourniquets, both manufactured and improvised (Class IIa, LOE C-EO).	new for 2015
2015	Trauma Emergencies: Control of Bleeding	Hemostatic dressings may be considered by first aid providers when standard bleeding control (direct pressure with or without gauze or cloth dressing) is not effective for severe or life-threatening bleeding (Class IIb, LOE C-LD).	updated for 2015
2015	Trauma Emergencies: Control of Bleeding	Proper application of hemostatic dressings requires training (Class I, LOE C-EO).	updated for 2015
2015	Trauma Emergencies: Open Chest Wounds	We recommend against the application of an occlusive dressing or device by first aid providers for individuals with an open chest wound (Class III: Harm, LOE C-EO).	new for 2015
2015	Trauma Emergencies: Open Chest Wounds	In the first aid situation, it is reasonable to leave an open chest wound exposed to ambient air without a dressing or seal (Class IIa, LOE C-EO).	new for 2015
2015	Trauma Emergencies: Concussion	Any person with a head injury that has resulted in a change in level of consciousness, has progressive development of signs or symptoms as described above, or is otherwise a cause for concern should be evaluated by a healthcare provider or EMS personnel as soon as possible (Class I, LOE C-EO).	new for 2015
2015	Trauma Emergencies: Concussion	Using any mechanical machinery, driving, cycling, or continuing to participate in sports after a head injury should be deferred by these individuals until they are assessed by a healthcare provider and cleared to participate in those activities (Class I, LOE C-EO).	new for 2015
2015	Trauma Emergencies: Spinal Motion Restriction	With a growing body of evidence showing more actual harm and no good evidence showing clear benefit, we recommend against routine application of cervical collars by first aid providers (Class III: Harm, LOE C-LD).	updated for 2015
2015	Trauma Emergencies: Spinal Motion Restriction	If a first aid provider suspects a spinal injury, he or she should have the person remain as still as possible and await the arrival of EMS providers (Class I, LOE C-EO).	new for 2015
2015	Musculoskeletal Trauma	In general, first aid providers should not move or try to straighten an injured extremity (Class III: Harm, LOE C-EO).	updated for 2015
2015	Musculoskeletal Trauma	In such situations, providers should protect the injured person, including splinting in a way that limits pain, reduces the chance for further injury, and facilitates safe and prompt transport (Class I, LOE C-EO).	updated for 2015
2015	Musculoskeletal Trauma	If an injured extremity is blue or extremely pale, activate EMS immediately (Class I, LOE C-EO).	new for 2015
2015	Burns	Cool thermal burns with cool or cold potable water as soon as possible and for at least 10 minutes (Class I, LOE B-NR).	updated for 2015
2015	Burns	If cool or cold water is not available, a clean cool or cold, but not freezing, compress can be useful as a substitute for cooling thermal burns (Class IIa, LOE B-NR).	new for 2015
2015	Burns	Care should be taken to monitor for hypothermia when cooling large burns (Class I, LOE C-EO).	new for 2015
2015	Burns	After cooling of a burn, it may be reasonable to loosely cover the burn with a sterile, dry dressing (Class IIb, LOE C-LD).	updated for 2015
2015	Burns	In general, it may be reasonable to avoid natural remedies, such as honey or potato peel dressings (Class IIb, LOE C-LD).	new for 2015
2015	Burns	However, in remote or wilderness settings where commercially made topical antibiotics are not available, it may be reasonable to consider applying honey topically as an antimicrobial agent (Class IIb, LOE C-LD).	new for 2015
2015	Burns	Burns associated with or involving (1) blistering or broken skin; (2) difficulty breathing; (3) the face, neck, hands, or genitals; (4) a larger surface area, such as trunk or extremities; or (5) other cause for concern should be evaluated by a healthcare provider (Class I, LOE C-EO).	new for 2015
2015	Dental Injury	In situations that do not allow for immediate reimplantation, it can be beneficial to temporarily store an avulsed tooth in a variety of solutions shown to prolong viability of dental cells (Class IIa, LOE C-LD).	updated for 2015
2015	Dental Injury	If none of these solutions are available, it may be reasonable to store an avulsed tooth in the injured persons saliva (not in the mouth) pending reimplantation (Class IIb, LOE C-LD).	new for 2015

(*Continued*)

2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2015	Dental Injury	Following dental avulsion, it is essential to seek rapid assistance with reimplantation (Class I, LOE C-EO).	new for 2015
The following recommendations were not reviewed in 2015. For more information, see the *2010 AHA and American Red Cross Guidelines for First Aid*, "Part 17: First Aid."			
2010	Oxygen	There is insufficient evidence to recommend routine use of supplementary oxygen by a first aid provider for victims complaining of chest discomfort or shortness of breath (Class IIb, LOE C).	not reviewed in 2015
2010	Anaphylaxis	First aid providers should also know how to administer the auto-injector if the victim is unable to do so, provided that the medication has been prescribed by a physician and state law permits it (Class IIb, LOE B).	not reviewed in 2015
2010	Tourniquets	Specifically designed tourniquets appear to be better than ones that are improvised, but tourniquets should only be used with proper training (Class IIa, LOE B).	not reviewed in 2015
2010	Thermal Burns	Don't apply ice directly to a burn; it can produce tissue ischemia (Class III, LOE B).	not reviewed in 2015
2010	Spine Stabilization	Because of the dire consequences if secondary injury does occur, maintain spinal motion restriction by manually stabilizing the head so that the motion of head, neck, and spine is minimized (Class IIb, LOE C).	not reviewed in 2015
2010	Sprains and Strains	Place a barrier, such as a thin towel, between the cold container and the skin (Class IIb, LOE C).	not reviewed in 2015
2010	Hypothermia	If the hypothermia victim is far from definitive health care, begin active rewarming (Class IIa, LOE B) although the effectiveness of active rewarming has not been evaluated.	not reviewed in 2015
2010	Seizures	Placing an object in the victim's mouth may cause dental damage or aspiration (Class IIa, LOE C).	not reviewed in 2015
2010	Wounds and Abrasions	Superficial wounds and abrasions should be thoroughly irrigated with a large volume of warm or room temperature potable water with or without soap until there is no foreign matter in the wound (Class I, LOE A).	not reviewed in 2015
2010	Wounds and Abrasions	Wounds heal better with less infection if they are covered with an antibiotic ointment or cream and a clean occlusive dressing (Class IIa, LOE A).	not reviewed in 2015
2010	Burn Blisters	Loosely cover burn blisters with a sterile dressing, but leave blisters intact because this improves healing and reduces pain (Class IIa, LOE B).	not reviewed in 2015
2010	Electric Injuries	Do not place yourself in danger by touching an electrocuted victim while the power is on (Class III, LOE C).	not reviewed in 2015
2010	Human and Animal Bites	Irrigate human and animal bites with copious amounts of water (Class I, LOE B).	not reviewed in 2015
2010	Snakebites	Do not apply suction as first aid for snakebites (Class III, LOE C).	not reviewed in 2015
2010	Snakebites	Applying a pressure immobilization bandage with a pressure between 40 and 70 mm Hg in the upper extremity and between 55 and 70 mm Hg in the lower extremity around the entire length of the bitten extremity is an effective and safe way to slow the dissemination of venom by slowing lymph flow (Class IIa, LOE C).	not reviewed in 2015
2010	Jellyfish Stings	To inactivate venom load and prevent further envenomation, jellyfish stings should be liberally washed with vinegar (4% to 6% acetic acid solution) as soon as possible for at least 30 seconds (Class IIa, LOE B).	not reviewed in 2015
2010	Jellyfish Stings	For the treatment of pain, after the nematocysts are removed or deactivated, jellyfish stings should be treated with hot-water immersion when possible (Class IIa, LOE B).	not reviewed in 2015
2010	Jellyfish Stings	If hot water is not available, dry hot packs or, as a second choice, dry cold packs may be helpful in decreasing pain but these are not as effective as hot water (Class IIb, LOE B).	not reviewed in 2015
2010	Jellyfish Stings	Topical application of aluminum sulfate or meat tenderizer, commercially available aerosol products, fresh water wash, and papain, an enzyme derived from papaya used as a local medicine, are even less effective in relieving pain (Class IIb, LOE B).	not reviewed in 2015
2010	Jellyfish Stings	Pressure immobilization bandages are not recommended for the treatment of jellyfish stings because animal studies show that pressure with an immobilization bandage causes further release of venom, even from already fired nematocysts (Class III, LOE C).	not reviewed in 2015
2010	Frostbite	Do not try to rewarm the frostbite if there is any chance that it might refreeze or if you are close to a medical facility (Class III, LOE C).	not reviewed in 2015
2010	Frostbite	Severe or deep frostbite should be rewarmed within 24 hours of injury and this is best accomplished by immersing the frostbitten part in warm (37° to 40°C or approximately body temperature) water for 20 to 30 minutes (Class IIb, LOE C).	not reviewed in 2015
2010	Frostbite	Chemical warmers should not be placed directly on frostbitten tissue because they can reach temperatures that can cause burns (Class III, LOE C).	not reviewed in 2015
2010	Chemical Burns	In case of exposure to an acid or alkali on the skin or eye, immediately irrigate the affected area with copious amounts of water (Class I, LOE B).	not reviewed in 2015

(*Continued*)

2015 Guidelines Update: Master List of Recommendations, *Continued*

Year Last Reviewed	Topic	Recommendation	Comments
2010	Treatment With Milk or Water	Do not administer anything by mouth for any poison ingestion unless advised to do so by a poison control center or emergency medical personnel because it may be harmful (Class III, LOE C).	not reviewed in 2015
2010	Activated Charcoal	Do not administer activated charcoal to a victim who has ingested a poisonous substance unless you are advised to do so by poison control center or emergency medical personnel (Class IIb, LOE C).	not reviewed in 2015
2010	Ipecac	Do not administer syrup of ipecac for ingestions of toxins (Class III, LOE B).	not reviewed in 2015

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